A PROSPECTIVE STUDY ON THE OUTCOME OF EARLY POSTOPERATIVE ACTIVE MOBILISATION FOLLOWING TENDON TRANSFER PROCEDURES FOR CLAW HAND CORRECTION

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CHENNAI, TAMIL NADU

CERTIFICATE

This is to certify that this dissertation entitled "**A PROSPECTIVE STUDY ON THE OUTCOME OF EARLY POSTOPERATIVE ACTIVE MOBILISATION FOLLOWING TENDON TRANSFER PROCEDURES FOR CLAW HAND CORRECTION**" is the bonafide work done by **Dr.P.MURUGESHKUMAR**, under my supervision in the Department of Orthopaedic Surgery, Madurai Medical College, Madurai-20.

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DECLARATION

I **Dr.P.MURUGESHKUMAR** , solemnly declare that the dissertation titled **"A PROSPECTIVE STUDY ON THE OUTCOME OF EARLY POSTOPERATIVE ACTIVE MOBILISATION FOLLOWING TENDON TRANSFER PROCEDURES FOR CLAW HAND CORRECTION** " has been prepared by me. This is being submitted to **"The Tamil nadu Dr. M.G.R. Medical University, Chennai** in partial fulfilment of the regulations for the award of M S degree branch II orthopaedics.

Place : Madurai **Dr.P.MURUGESHKUMAR**

Date :

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CONTENTS

INTRODUCTION

Post operative immobilization of the hand in a cast is the conventional practice following the tendon transfer for the claw hand deformity correction. The wrist and the Metacarpophalangeal joints (MCP) are immobilized for a period of 4 weeks following the Zancolli's lasso procedure for claw deformity correction. After cast removal, 4 weeks is required for the tendon transfer re-education before the patient is allowed to use the hand for daily living activities. The period of morbidity with the post-operative immobilization of the hand extends up to 7-8 weeks. Post immobilization stiffness may increase the rehabilitation time and further delay in return to activities.

The concept of immediate active mobilization of tendon transfer was reported recently by Rath. His immediate post operative active mobilisation trial shows the benefit of 40% reduction in rehabilitation time .

To test this concept on tendon transfer for claw deformity correction , we did a prospective study of an Analysis of results of Early Postoperative Active Mobilization following FDS middle finger 4 tail pulley insertions (4TP) for claw hand correction (Lasso procedure). The outcomes of this procedure were compared with conventional immobilization in a cast for claw hand deformity correction.

AIM OF THE STUDY

To Test the safety, efficacy and reliability of early postoperative active mobilisation after tendon transfer surgery and to compare the outcomes with those after conventional post operative immobilisation in the claw hand deformity correction

REVIEW OF LITERATURE

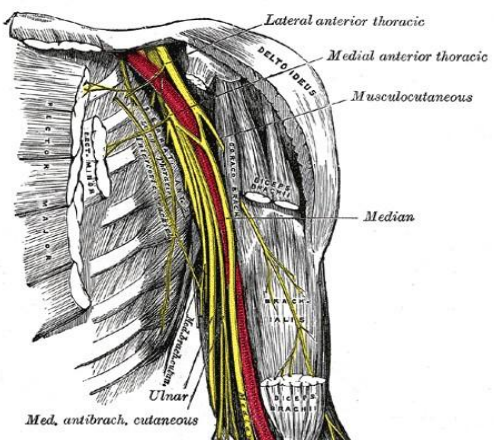
ULNAR NERVE ANATOMY

Orgin of the ulnar nerve

The ulnar nerve arises from the medial cord of brachial plexus and is composed of fibers from the anterior rami of C8 and T1.

Ulnar nerve in the Axilla and Arm.

In the axilla , the ulnar nerve is medial and adjacent to the axillary artery. At the inferior border of the subscapularis muscle , the ulnar nerve may receive additional fibers of the C7 nerve through the lateral root of the ulnar nerve. It runs distally through the axilla medial to the axillary artery, between it and the vein. The ulnar nerve pierces the medial intermuscular septum 8 cm proximal to the medial epicondyle[1] as the nerve passes from the anterior compartment to posterior compartment through the medial intermuscular septum.Then it passes deep to the arcade of Struthers.



Ulnar nerve in the axilla

The ulnar nerve remains on the medial aspect of the superior ulnar collateral artery. Both nerve and artery continue distally and medially on the anterior surface of the medial head of the triceps muscle. Then the ulnar nerve enters the interval between the medial epicondyle of the humerus and the olecranon, and passes onto the ulnar groove on the dorsal aspect of medial epicondyle. The ulnar nerve does not normally innervate any muscles in the arm, although the muscular branch to the flexor carpi ulnaris may branch from the ulnar nerve 1 cm proximal to the medial epicondyle.[2]

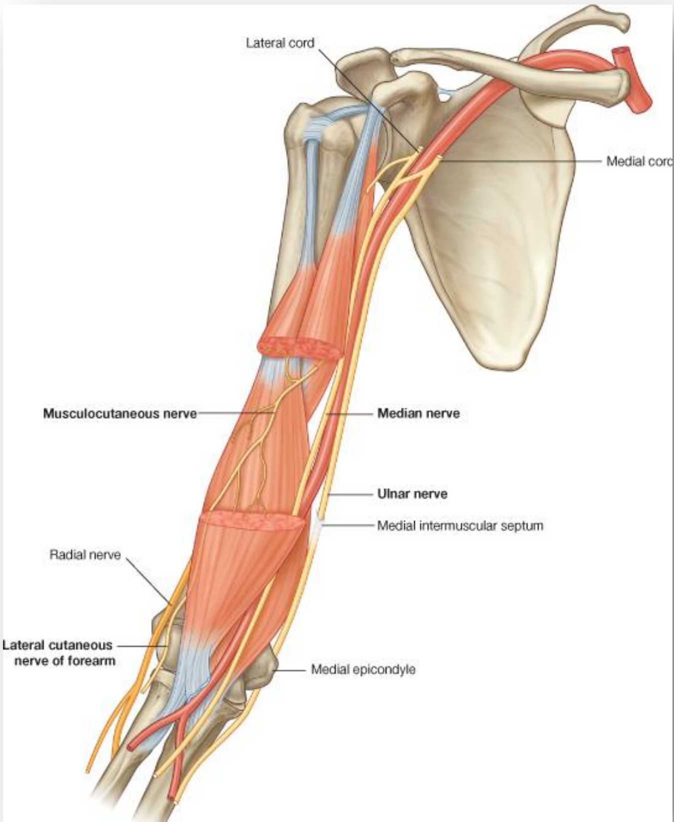


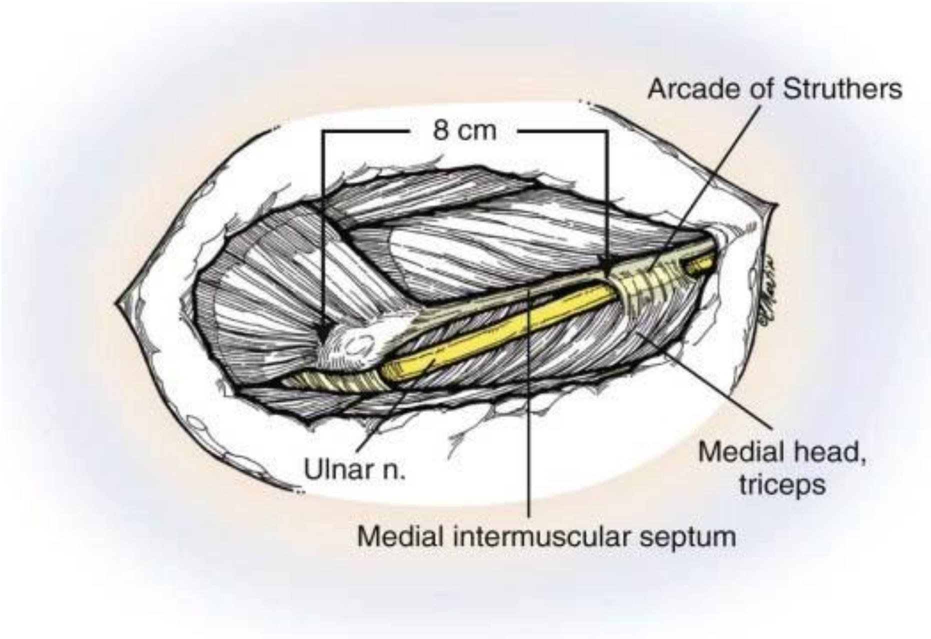
Fig 2. Ulnar nerve course in the arm and elbow

ANOMALOUS VARIATION OF ULNAR NERVE IN THE AXILLA AND ARM.

The ulnar nerve normally originates from the medial cord of brachial plexus. It may receive fibers from several other sources, including lateral cord , the middle trunk, and the anterior division of the middle trunk. These neural elements are collectively referred to as the lateral root of the ulnar nerve.

ARCADE OF STRUTHERS

As the ulnar nerve passes from the anterior to posterior compartment of the arm, it may encounter a myofibrous or faciomyofibrous band called the arcade of Struthers . This common structure was first described by Struthers in 1854[3]. It is a fibrous or fascial sheet located in the distal third of the medial aspect of the humerus. It is formed by a thickening of the deep investing facia of the distal part of the arm , and by superficial muscular fibers of the medial head of the triceps [4]. The anterior border of the arcade of Struthers is the medial intermuscular septum. The lateral border of the arcade is formed by the medial aspect of the humerus covered by deep muscular fibers of the medial head of the triceps. The arcade of Struthers may be a potential area of compression. If compression is present , the fascial sheet of the arcade of the struthers should be incised.



The arcade of struthers

THE FIRST BRANCH OF THE ULNAR NERVE.

The articular branch , normally the first branch of the ulnar nerve , exits from the main trunk in the ulnar groove and passes horizontally into the joint. The first muscular branch usually to the flexor carpi ulnaris exits immediately distal to the articular branch.

ULNAR NERVE IN THE ELBOW AND FOREARM.

Ulnar nerve in the cubital Tunnel

The cubital tunnel at the elbow is a fibro osseous tunnel[2]. The lateral border consists of the humerus, ulna, and elbow joint. The medial and inferior border consists of a fascial sheath confluent with the brachial and antebrachial fascia of the adjacent muscles. The distal medial border consists of the aponeurosis or fascia between the two heads of flexor carpi ulnaris [4, 8,9]. As noted by Siegel and Gelberman the tunnel can be divided geographically into three parts . The first part , usually provides one branch or several small articular branches to the elbow.

The second and middle part of the tunnel consists of a fascial arcade. The nerve usually gives off two branches to innervate the flexor carpi ulnaris. One branch usually supplies the humeral head and one supplies the ulnar head

In the second portion of the cubital tunnel, the distance between the medial humeral epicondyle and the olecranon is the shortest with elbow extension. This distance increases with elbow flexion. The roof of the cubital tunnel is formed by the fascial arcade, which becomes taut with elbow flexion.

The third and most distal part of the tunnel consists of the muscle bellies of the flexor carpi ulnaris.The nerve then continues distally in the forearm between the flexor digitorum profundus , located dorsally and laterally to the nerve, and the flexor carpi ulnaris located anteriorly and medially. The nerve runs a straight course through the forearm. In the distal third of the forearm ,the ulnar nerve courses more superficially , lying just radial and deep to the flexor carpi ulnaris[2].

Motor Branches Of The Ulnar Nerve In The Forearm.

In the forearm, and distal to the exit of the motor branches to the flexor carpi ulnaris, the ulnar nerve usually has three additional main branches. These are the motor branch to the flexor digitorum profundus(to the ring and small fingers), the palmar cutaneous portion of the ulnar nerve and the dorsal branch of the ulnar nerve[2,7].

Palmar cutaneous branch of the ulnar nerve

It arises a vriable levels from the ulnar nerve in the distal forearm. It innervates the skin in the hypothenar eminence, ulnar artery and occasionally , the Palmaris brevis muscle.

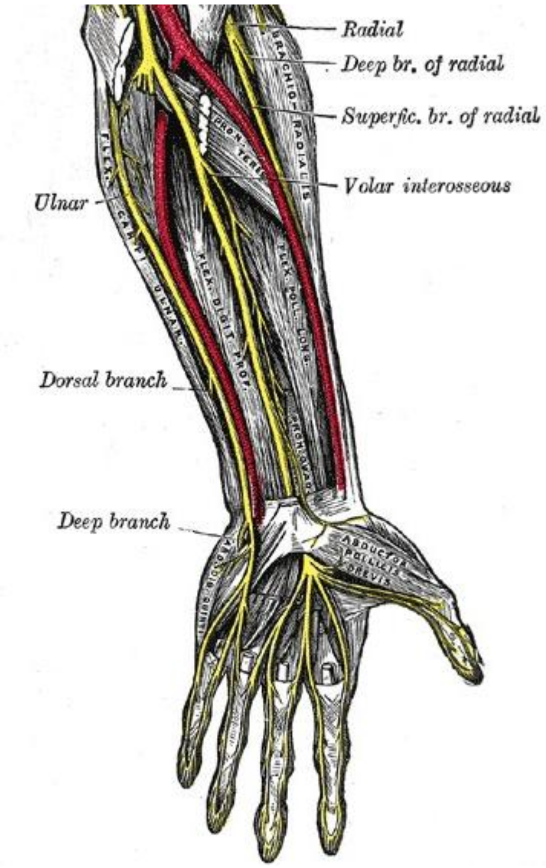
In 80% of upper limbs a single branch from the ulnar nerve supplies the flexor digitorum profundus. In appropriately 20% two or more branches supply the muscle.

Dorsal cutaneous branch of the ulnar nerve

It arises from the medial aspect of main ulnar nerve trunk in the distal forearm and curves dorsally to supply cutaneous innervation to the dorsal aspect of the small finger and ring finger[7,8,9]

Anomalous connection between the ulnar and median nerve

In the distal forearm, a crossing of nerve fibers from the ulnar nerve to the median nerve can occur, although with less frequency than the more common crossing of fibers in the opposite direction from median nerve or anterior interosseus nerve to the ulnar nerve (Martin - Gruber anastomosis).



The ulnar nerve in the forearm

Variations in innervation of the Flexor Digitorum Profundus muscle

The ulnar nerve is thought to innervate the flexor digitorum profundus to the ring and little fingers, and the median nerve innervates the index and long fingers. However this pattern was found in only 50% of upper limbs. In several specimens, the median nerve was found to innervate the ring and little fingers and ulnar nerve was found to supply the long finger. It is more common for the median nerve to innervate muscles traditionally supplied by the ulnar nerve than for the ulnar nerve to innervate muscles usually supplied by the median nerve[18,19,20].

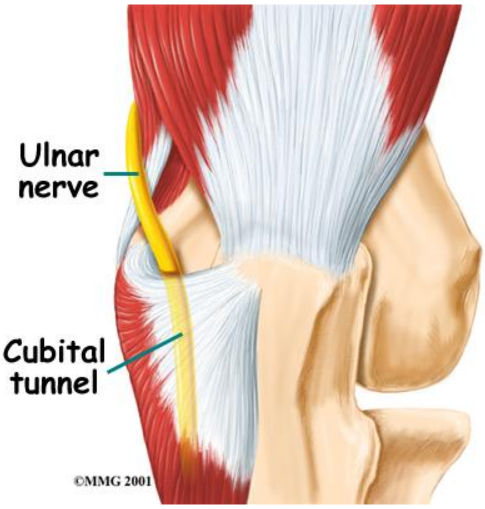
Many of the variations in branching occur in the muscle belly of the flexor digitorum profundus, and therefore are difficult to identify by superifical visualization and examination of the muscle. The flexor digitorum profundus to the index finger, however does seem to be innervated most consistently by the median nerve.

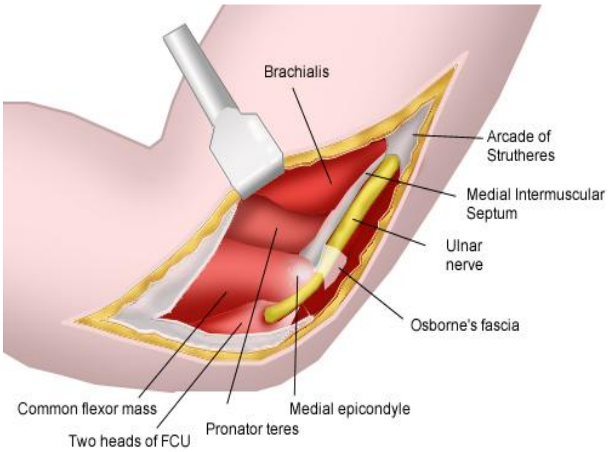
Ulnar nerve compression by Anamolous Anconeus Epitrochlearis

The ulnar nerve may be compressed at the elbow by an anomalous muscle, the anconeus epitrochlearis. The anconeus epitrochlearis originates from the medial border of the olecranon and adjacent triceps tendon and inserts into the medial epicondyle of the elbow.

CUBITAL TUNNEL SYNDROME.

Chronic compression of the ulnar nerve at the cubital tunnel may occur as a result of ischemia or mechanical compression by repeated elbow flexion, post-traumatic scarring, anomalous musculature, or direct compression, although the exact cause may be difficult to identify. Acute trauma to the ulnar nerve from periarticular elbow fractures or subsequent surgery may compromise ulnar nerve function. Ulnar nerve subluxation may also contribute to cubital tunnel syndrome. The area within the cubital tunnel is decreased with elbow flexion, and this can increase pressure on the cubital tunnel. Apfelberg and Larson reported a 55% decrease in cubital tunnel area with elbow flexion[21]. Pechan and Julius reported increased pressure within the cubital tunnel with elbow flexion, and this pressure was further compromised with wrist extension or shoulder abduction or with both





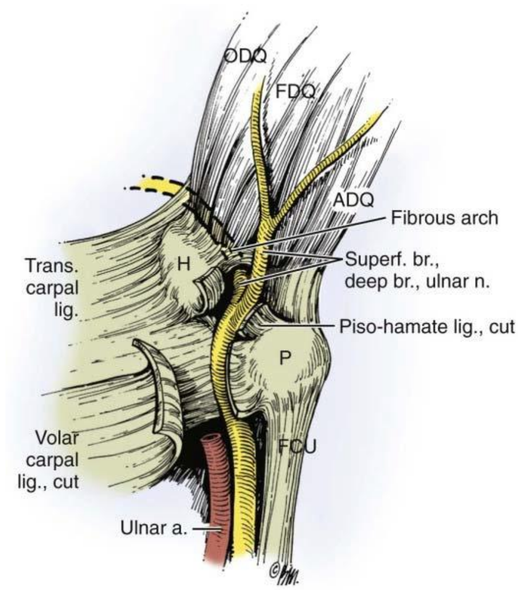
ULNAR NERVE AT THE WRIST AND HAND

Ulnar nerve in the ulnar tunnel

The ulnar nerve and ulnar artery enter the ulnar tunnel (Guyon's canal) at the wrist. The artery is usually located radial to the nerve[22]. The nerve and artery pass radial to the pisiform, anterior to the transverse carpal ligament (flexor retinaculum) and dorsal to the superficial palmar carpal ligament. The ulnar nerve divides into deep terminal and superficial palmar branches at the base of the hypothenar eminence.

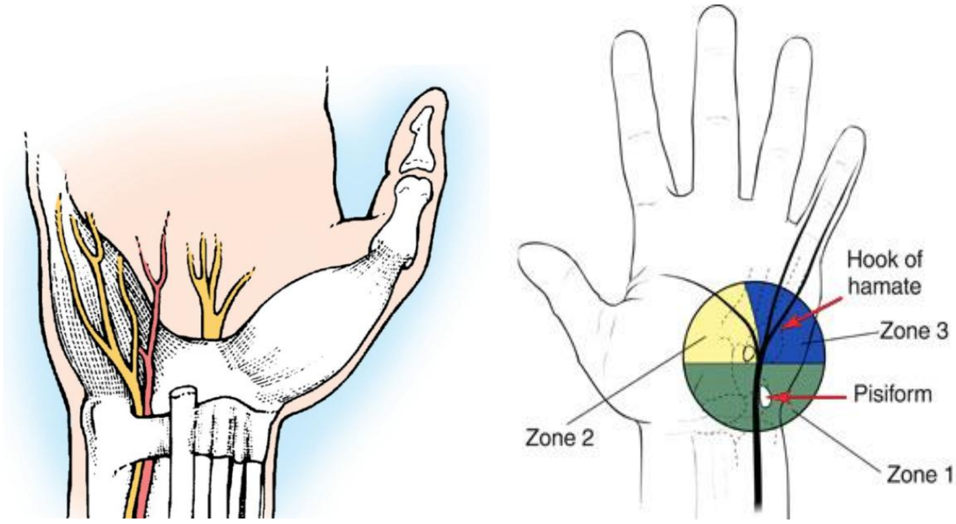
Compression of Guyon's Canal

Compression in Guyon's canal may result from a number of causes



The anatomy of Guyon's canal

including acute or repetitive trauma, hammate hook nonunion, anomalous muscles, or space-occupying lesions, including ganglions, thrombosis, and pseudoaneurysms.



Guyon's canal

The unique anatomy of Guyon's canal will influence the symptoms. The nerve can be compressed proximal to its bifurcation (zone I), thereby yielding a mix of both motor and sensory deficits; along the course of the deep motor branch (zone II), characterized by pure motor loss; or along its superficial sensory branch (zone III), which is associated with pure sensory changes[23].

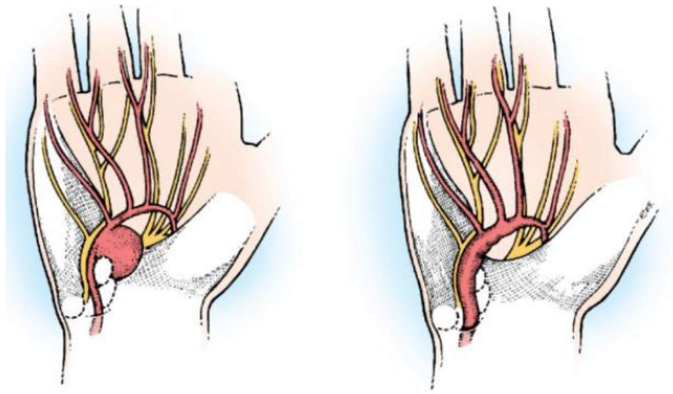


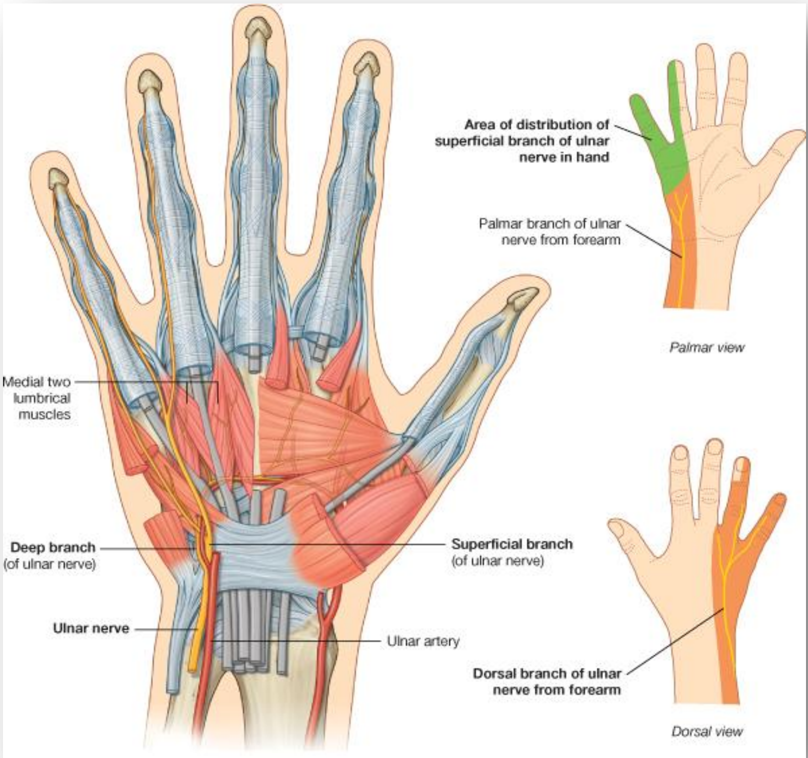
Figure shows the two types of traumatic aneurysms of ulnar artery in hand. Saccular “false” aneurysm arising from ulnar artery.

Superficial palmar branch of the ulnar nerve

The superficial palmar branch exits the distal ulnar tunnel with the superficial terminal branch of the ulnar artery. The nerve then provides several small twigs to innervate the skin on the medial side of the hand. The motor branches to the Palmaris brevis may leave the nerve at this point . The nerve continues distally and radially and divides into the proper digital nerve to the ulnar side of the little finger and the common palmar digital nerve to the fourth web space. At the level of metacarpal shafts the common digital nerves divides into two proper digital nerves, one each to supply adjacent aspects of the fourth web space between the small and ring fingers. In the palm, the nerves lies dorsal to the superficial palmar arch and palmar to the flexor tendons. Immediately after division, in the region of the metacarpal necks, the proper digital nerves course anteriorly to lie palmar to the digital arteries. The neurovascular bundles are stabilized in the digits by the retaining skin ligaments, cleland's ligaments located dorsal to the neurovascular bundle, and grayson's ligaments located palmarly.

Deep terminal branch of the ulnar nerve

It exits from the zone II of the ulnar tunnel dorsoulnar to the deep terminal branch of the ulnar artery[23,24]. The nerve passes medial to the hook of hamate, deep to the fibrous arch of the hypothenar muscle origin



The ulnar nerve in the course in the hand

The proper digital nerves supply the palmar skin of the digits, and the skin distal to the distal interphalangeal joints on the dorsal surface.

. The nerve continues between the abductor digiti minimi and flexor digiti minimi muscles supplying motor branches to each. The nerve then pierces and innervates the opponens digiti minimi[26]. The deep branch then crosses the palm with the ulnar artery. Along its course, the nerve is deep to the extrinsic flexor tendons and deep to the mid palmar and thenar fascial clefts, but palmar to the interossei. At the level of the third metacarpal, the deep branch of the ulnar nerve cross between the oblique and transverse heads of the adductor pollicis.

Along its deep course, the nerve innervates each of the seven interossei[15], the third and fourth lumbricals , the adductor pollicis, the flexor pollicis brevis, and the hypothenar muscles. The deep terminal branch provides sensory afferent to nerves to the ulno carpal , intercarpal, and carpo metacarpal joints.

Riche – cannieu communication

The Riche-Cannieu communication consists of a communication between the deep terminal branch of the ulnar nerve and the motor branch of the median nerve[27].

ULNAR NERVE PALSY

Ulnar nerve palsy is common with leprosy in areas where this disease is endemic, but it most commonly occurs after a traumatic injury to the ulnar nerve . Traumatic ulnar nerve palsy may either due to the open or the closed injuries. The open injuries can occur with the sharp weapon and the closed injuries can occur with posterior dislocation of the elbow and Medial epicondyle fractures. The Tardy ulnar neve palsy is due to cubitus valgus deformity or severe compression of the ulnar nerve in the cubital tunnel called as cubital tunnel syndrome . Compression may be either due to osteoarthritis , an enlarging synovial cyst , or anomalous accessory muscle , fibrous bands , or ligaments in the cubital tunnel. Less frequently, the ulnar nerve may be compressed in Guyon's canal at the wrist, which may result in loss of intrinsic muscle function without loss of sensation. Recurrent subluxation of the ulnar nerve can also cause the ulnar nerve palsy . Injury to the medial cord of the brachial plexus, compression of the T1 nerve root and neurologic diseases such as syringomyelia, hereditary motor and sensory neuropathy (Charcot-Marie-Tooth disease), poliomyelitis, and motor neuron disease may mimic ulnar nerve palsy

Ulnar nerve injuries are classified as high or low. Low injuries occur distal to the origins of the motor branches to the FCU and ring and little finger flexor digitorum profundus (FDP) muscles. Strength of the extrinsic hand muscles is unaffected, but sensation is lost on the ulnar border of the hand and in the ring and little fingers, and the ulnar-innervated intrinsic muscles are paralyzed. This results in weakness of thumb pinch, claw deformity, loss of the normal pattern of finger flexion, and significant loss of hand dexterity and strength[28,29]. High injuries occur above the origins of the motor branches to the FCU and ring and little finger FDP muscles. In this situation, loss of active ring and little DIP joint flexion and wrist flexion compound the aforementioned findings, although paradoxically, the claw deformity tends to be less severe

Ulnar nerve palsy in leprosy

In 1948 Dr.paul brand pioneered reconstructive surgery on patients afflicted with leprosy and performed the first correction of claw hand at the Christian Medical College hospital , vellore, India. He evolved a system of detailed clinical evaluation and introduced modalities of preoperative approach for correction of deformity and new procedures for claw hands. Some of these have remained the ‘ work horse’ for surgeons treating leprosy and are used as the standard by which all other procedures are evaluated. The other Indian authors who are pioneers of reconstruction surgery of hands affected with leprosy are Palande , H.Srinivasan , Antia .

In leprosy there is profound loss of sensation along the Ulnar nerve distribution. Patients may present with blisters or ulceration in the little and ring fingers, which in some instances may be the actual reason for them to seek medical attention rather than for nerve pain, weakness or hypopigmented patches on the skin. This is primarily due to the insidious nature of clinical manifestations of leprosy while the patient unknowingly delays seeking medical attention.

Clinical features of ulnar nerve paralysis

Clinical examination should preferably begin with observing the outstretched hand. The obvious characteristic is a claw deformity also referred to as the "benediction" hand because of the conspicuous flexion deformities in the little and ring fingers with a lesser degree of involvement of the middle and index fingers. The palmar aspect of the hand is next viewed by placing it palm tip on the table to note the flattened palm and wasting of the hypothenar region as well as a shallow mid palmar space distal to the thenar and hypothenar eminences . Supple and delicate hands show longitudinal palmar furrows between prominent long flexors beneath the palmar skin that indicate wasting of lumbricals.

The dorsum of the hand shows pronounced wasting with shallow concavities between the intermetacarpal space of the interosseus muscles and particularly of the thumb web. The hand proper takes on the shape of an isosceles triangle with its base distally rather than the normal rectangular contour. This change of configuration is mainly due to the absence of the hypothenar muscle bulge medial to the fifth metacarpal and the combined adductor pollicis and first dorsal interosseus muscle . Manual workers or those engaged in heavy hands on rural farming demonstrate the dorsal wasting and contour changes in the ulnar palsied hand remarkably well.

DISABILITY IN THE CLAW HAND

Loss of intrinsic muscle power may cause hyperextension of the metacarpophalangeal joints in a mobile hand; however, this deformity usually is not the primary or most disabling aspect of this paralysis. It has been shown that with intrinsic paralysis, grasp is diminished 50% or more because of the lack of power of flexion at the metacarpophalangeal joints. In addition, there is asynchronous movement in flexion of the fingers themselves . The roll-up maneuver of the fingers in the intrinsically paralyzed hand shows this characteristic .

The interphalangeal joints must flex first, followed next by the metacarpophalangeal joints and ultimately by full flexion of the fingers. The flexion of the metacarpophalangeal joints is lost with the loss of intrinsic muscle power; the hand is unable to grasp a large object. it also lacks power of grasp because metacarpophalangeal flexion depends entirely on the long flexors in the absence of intrinsics.

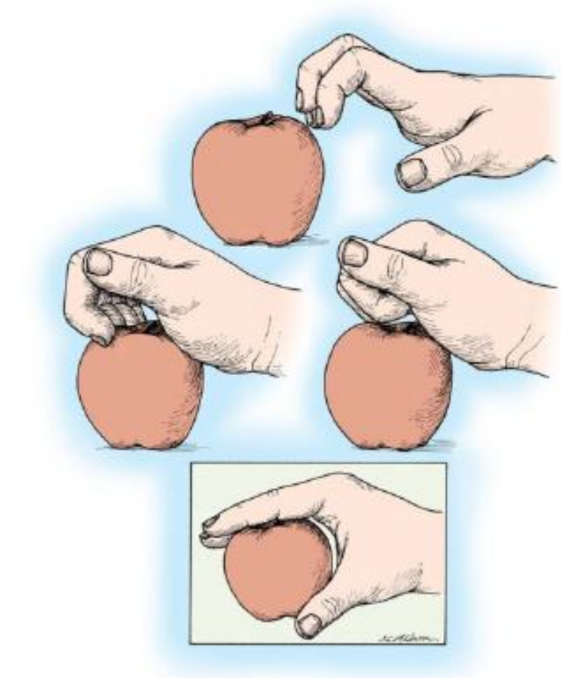


Figure shows the Flexion of metacarpophalangeal joint occurs only after interphalangeal joints are fully flexed. Fingers curl into hand and push away any large object they wish to grasp

Power of pinch also is diminished in addition to the effects of paralysis of the thenar muscles because the collateral ligaments of the metacarpophalangeal joints of the fingers are lax in extension, and the stabilizing intrinsic musculature that would ordinarily give lateral stability is paralyzed. Divergence of the fingers is automatic with extension produced by the long extensor tendons, and as a result of the alignment of the finger flexors, convergence of the tips on grasping is automatic. To stabilize the fingers in extension at the metacarpophalangeal joint, especially for the resistance of the index finger to the pinch pressure of the thumb, the intrinsics are essential.

MUSCLE TESTING

The muscles which are to be tested in case of ulnar nerve palsy are Abductor digiti minimi, First dorsal interossei, FCU, FDP to little and ring fingers

Muscle testing for abductor digiti minimi

Specific signs and tests of Motor dysfunction[30]

Duchenne sign:

Claw deformity of fingers, hyperextension at MP joint and flexion at IP joints.

Bouvier's maneuver

When correcting the hyperextension at the MP joints results in full extension of the IP joints

Andre Thomas sign :

Increase in claw deformity when patient makes an effort to extend the fingers by flexing the wrist attempting to tenodese the extensor tendons

Pitres – Testut sign :

Inability to abduct the extended middle finger to the radial and ulnar side when the hand is placed on a flat surface a test for second and third dorsal interosseous muscles

Earle, valstou sign :

Inability to cross middle finger dorsally over the index finger or the index finger over the middle finger the cross your fingers test (a test of the first volar interosseus and second dorsal interosseous muscles)

Flatt sign

Loss of integration of MP and IP flexion Mp joint does not flex until IP joint flexion has been completed due to paralysis of the lumbrical muscles of the ring and little fingers

Brand

The fingers curl or roll into the palm and objects are pushed away instead of being grasped

Jeanne's sign

Hyperextension of the MP joint of thumb during key pinch or gross grip due to paralysis of the adductor pollicis muscle, which acts as first metacarpal adductor, flexor of the thumb MP joint and an extensor of the thumb IP joint.

Masse's sign :

Flattened metacarpal arch due to paralysis of the opponens digiti quinti and decreased range of flexion of the little finger MP joint

Froment's sign

Thumb interphalangeal joint flexion due to paralysis of first palmar and second dorsal interosseous and adductor pollicis muscle with flexor pollcis longus substituting their function

Bunnell’s O sign:

Combined hyperextension at MCP joint and hyper flexion at IP joint noticed when patient makes a pulp to pulp pinch with thumb and index finger

Smith sign:

Loss of active lateral mobility with the fingers in extension due to paralysis of interosseous and hypothenar muscles.

Wartenberg sign :

Inability to adduct the extended little finger to the extended ring finger.

Pollock’s sign:

Loss of extrinsic power with inability to flex the distal joint of the ring and little fingers due to weakness of FDP of ring and little fingers

Bowden and Napier :

Partial loss of wrist flexion with inability to perform power grip with wrist in neutral with paralysis of flexor carpi ulnaris

INDICATION FOR SURGERY

The ulnar Nerve paralysis of more than one year duration and Completion of multi-drug therapy for treatment of Hansen's disease. All MCP and PIP joints should be supple for tendon transfer

PRINCIPLE OF SURGERY

The interossei and lumbrical muscles flex the MCP and extend the IP joints of the fingers, but the long finger extensors are capable of extending the IP joints if the MCP joints are stabilized and cannot hyperextend . This principle is the basis for many of the surgical procedures

GOAL OF THE SURGERY[8]

The restoration of grasping power of hand and to improve the thumb pinch, Correction of finger clawing is more important . Restore the normal pattern of finger flexion.

In claw hand all four fingers show the disability of the intrinsic muscle paralysis and also paralysis of the index and middle fingers. All the introssei muscle palsy make the fingers weak . So all the four fingers should be operated.

SURGICAL PROCEDURES

Surgical procedures for claw correction are grouped into two categeries. It is divided into the Static procedures and the Dynamic procedures. The Static procedures commonly used in the Bouvier's positive hand (correcting the hyperextension at the MP joints results in full extension of the IP joints) . A tendon transfer should be done if the PIP joints remain flexed when the MP joint hyperextension is corrected . . If there are fixed flexion deformities of the IP joints, these need to be corrected before surgery

STATIC PROCEDURES

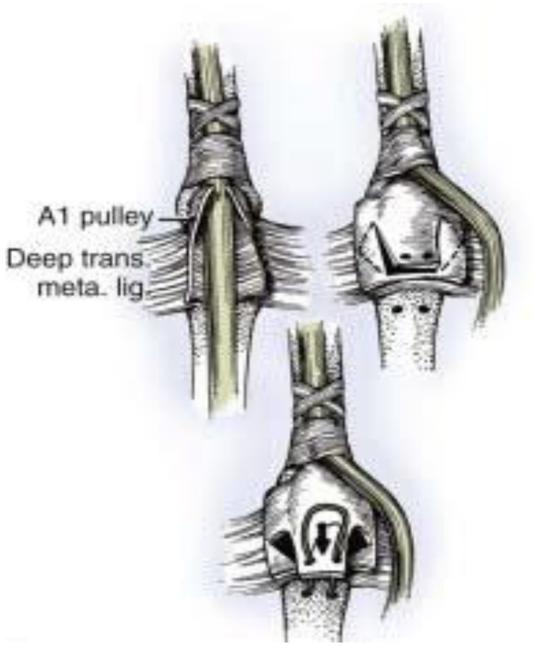
These prevent hyperextension of the finger MP joints by either shortening the palmar capsules or by creating “check rein” ligaments or tenodeses. Although bone blocks to prevent MP joint hyperextension[31], proximal flexor sheath release to cause bowstringing of the extrinsic finger flexors[32], and excision of an ellipse of skin and fascia from the palm of the hand to shorten the length of the palm (fasciodermadesis) have been described, these procedures are now rarely used.

PALMAR CAPSULODESIS OF METACARPOPHALANGEAL JOINT

ZANCOLLI'S TECHNIQUE[33]

Zancolli described a procedure using transverse incisions over the A1 pulley of each affected finger. The A1 pulley of each finger is completely divided , and the flexor tendons are retracted to one side to expose the palmar plate of the MP joint. Two parallel longitudinal incisions are made in the palmar plate, and its insertion onto the metacarpal neck is released, thus creating a capsular flap with its base attached to the base of the proximal phalanx. The MP joint is hyperextended to improve the exposure, and a small transverse bone tunnel is created in the metacarpal neck with a fine awl or Kirschner wire. The metacarpal neck is roughened with a curette or bur to create a bleeding bed for adherence of the capsular imbrication. Zancolli then passed a monofilament wire through the tunnel and the flap of the palmar plate with sufficient tension to maintain the MP joint in 20 degrees of flexion, after which he firmly twisted the ends of the wire and cut them to lie flat on the metacarpal. However, a small bone anchor with an attached 3-0 Vicryl suture is also ideal for attaching the capsular flaps onto metacarpal necks. The capsuloplasties are performed sequentially from the index to the little MP joint.

Omer[34] modified Zancolli's technique by cutting away a triangular portion of the deep transverse metacarpal ligament on each side of the palmar plate flap , but this is probably unnecessary. He also recommended excision of a 1.5-cm-wide ellipse of palmar skin to prevent stretching of the volar plate and immobilized the hand with the MP joints flexed for 6 weeks



Omers[34]modification of zancollis capsulodesis

DYNAMIC TENDON TRANSFERS

Many transfers have been described to correct finger clawing and these use a variety of muscles as motors. Commonly used tendons are the superficialis tendon transfers , the ECRL transfers and the EIP & EDM transfers

SUPERFICIALIS TENDON TRANSFER TECHNIQUES

Commonly used procedure are the Bunnel Procedue and the Lasso Procedure

SUPERFICIALIS INSERTION SITES

Burkhalter[35,36] inserted the superficialis slips onto the proximal phalanx in patients with traumatic ulnar nerve palsy to avoid the risk of PIP joint hyperextension, which may occur when the transfer is attached to the lateral band of the extensor apparatus . For the same reason, Riordan[37] recommended attaching the tendon slips to the A1 pulley if the PIP joints are lax and hyperextended . Zancolli[38] usually looped the tendon slips beneath the entire A1 pulley (lasso technique). Omer[34] preferred the A2 pulley over the A1 pulley as the insertion site to increase the force of MP flexion. Anderson and Oberlin performed “extended pulley insertions,” looping a slip of the superficialis tendon around both the A1 and the proximal portion of the A2 (A2a) pulleys in each finger .

STILES AND FORRESTER-BROWN PROCEDURE [41]

Transfer of one slip of each superficialis tendon into the corresponding extensor digitorum tendon over the proximal phalanx

STILES- BUNNEL PROCEDURE

Bunnell[42] modified the above procedure by rerouting both slips of all the superficialis tendons through the lumbrical canals and anchoring them into both the radial and ulnar lateral bands of the extensor mechanism . Bunnell's aim was to correct the claw deformity and restore MP abduction and adduction . It often resulted in the development of overcorrection and intrinsic-plus deformity

MODIFIED BUNNELL PROCEDURE

Littler[43] modified the Stiles-Bunnell procedure by using only the middle finger superficialis tendon

Modified bunnel procedure

ZANCOLLI LOOPED THE TENDON SLIPS BENEATH THE ENTIRE A1 PULLEY (LASSO TECHNIQUE)

Blocking the hyperextension by producing flexion of the metacarpophalangeal (MCP) joints can allow the extrinsic extensors to extend the interphalangeal (IP) joints. In the lasso procedure, the FDS tail is inserted into the A-1 or A-2 pulley of the flexor tendon sheath . A transverse incision is made at the level of distal palmar crease, then A1 pulleys of the flexor sheath exposed. The FDS tendon of the middle finger is exposed & withdrawn into the palm & divided into 4 slips . FDS tendon each tail is inserted into the A-1 or A-2 pulley . The limb is immobilised in POP cast with wrist in neutral, transverse metacarpal arch well formed and MCP in 70° flexion for 4 weeks

ECRL TRANSFERS

This can be divided into Dorsal route and Volar route transfers.

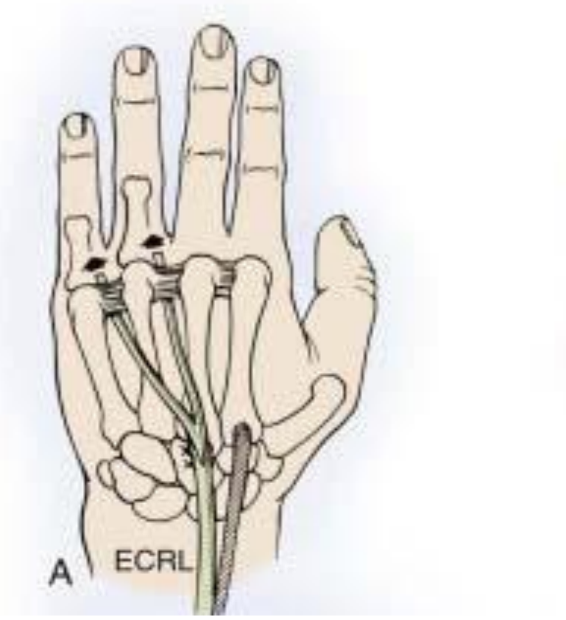
Dorsal Route Transfer of the ECRL[44] (BRAND- 1)

This dorsal route transfer was described by Brand. The ECRL or ECRB tendon is exposed at the site of their insertion through a short transverse incision . They are withdrawn into a second transverse incision 8 cm proximally in the distal forearm. The plantaris tendon is harvested and attached to the distal end of the motor's tendon. Brand advised a “wrap around” technique of anastomosis that resulted in its surface being covered with epitenon with no cut end of either the graft or the extensor tendon exposed to reduce adhesion formation .

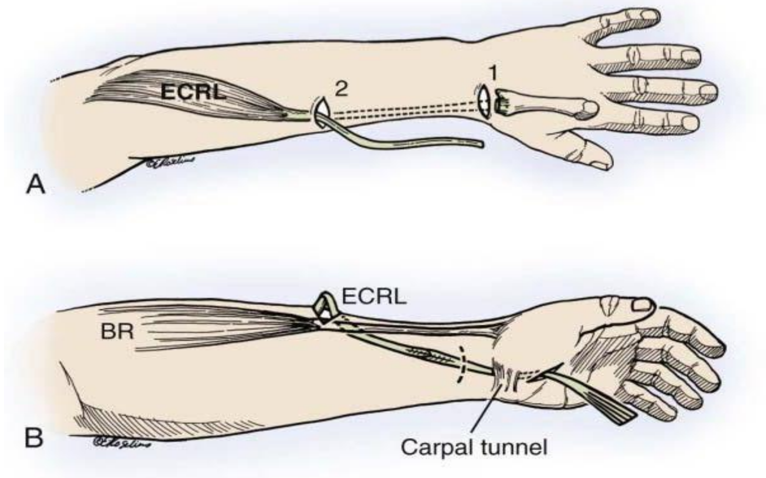
The plantaris tendon graft is split into four tails . Dorso radial incisions are made at the base of the middle, ring, and little fingers and the radial lateral band of each of finger and the ulnar lateral band of the index finger are identified. Tendon-tunneling forceps are passed from the finger incisions, through the lumbrical canals and intermetacarpal spaces, volar to the deep transverse metacarpal ligaments to emerge in the wrist wound. The tendon grafts for each of the fingers are passed and stitched in equal tension, suturing the index finger first, then the little finger and finally the middle and ring fingers .

Flexor Route Transfer of the ECRL[44]- BRAND -2 (EF4T)

The ECRL extended with graft is Passed through the carpal tunnel and routed through the lumbrical canal and attached to the radial lateral bands of the extensor expansions of middle , ring finger and ulnar lateral band of index finger .



ECRL transfer , Brand- 1procedure



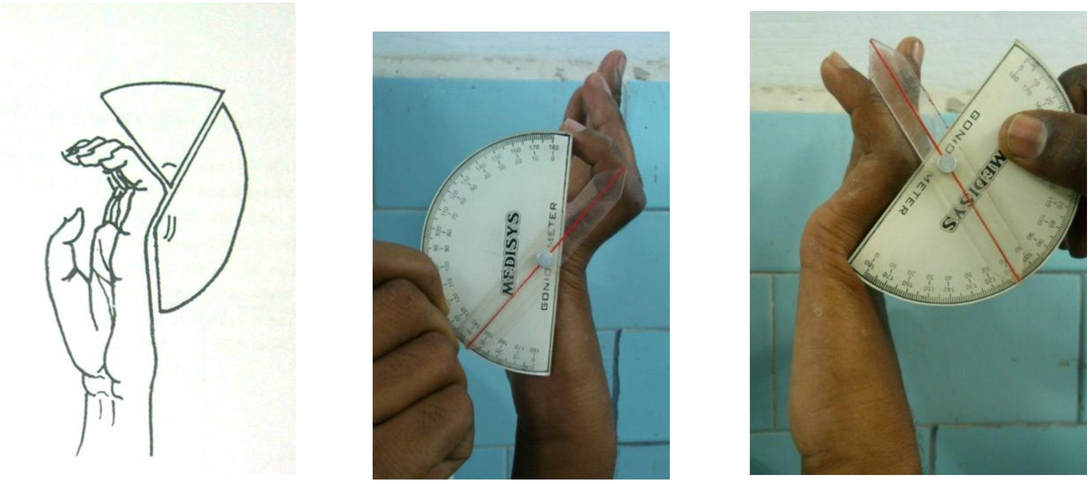
Flexor Route Transfer of the ECRL - BRAND -2

PRE OPERATIVE EVALUATION

The following angles are measured and recorded.

1.CLAW DEFORMITY ANGLE[59]

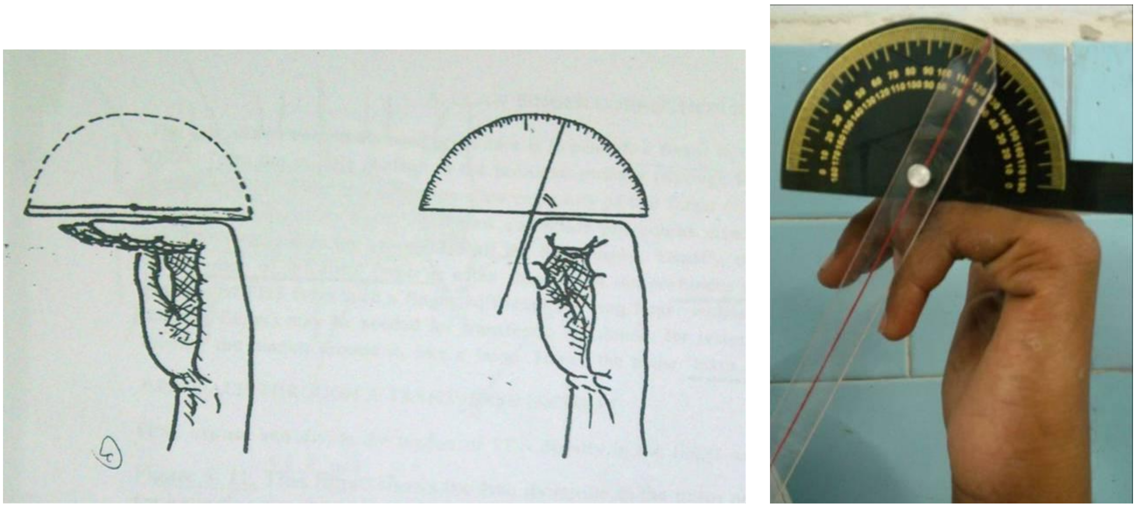
It is measured by precalibrated triangular discs & goniometer (srinivasan 1979). In a open hand position assess the hyperextension of MCP joint and flexion of PIPjoints angles were measured and recorded.



The deformity angle measurements

2.UNASSISTED EXTENSION ANGLE[59]

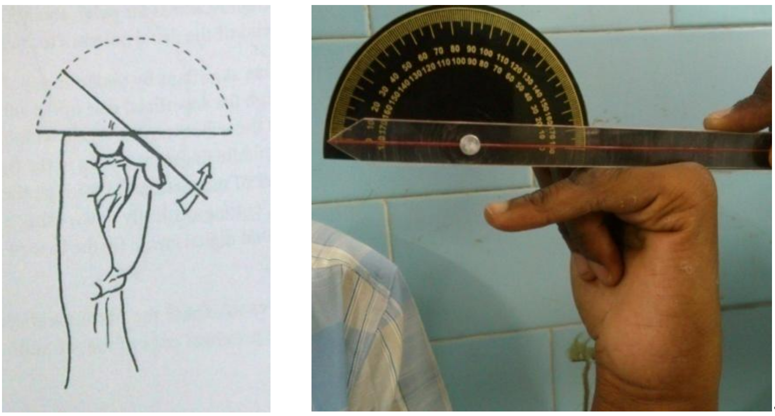
It is measured In the intrinsic plus position , flex the fingers fully at MCP joins and then extend the fingers fully at PIP joints . Measure the PIP joint flexion angle, In normal hand it is 0 degree



Unassisted angle measurements

3.ASSISTED EXTENSION ANGLE [59]

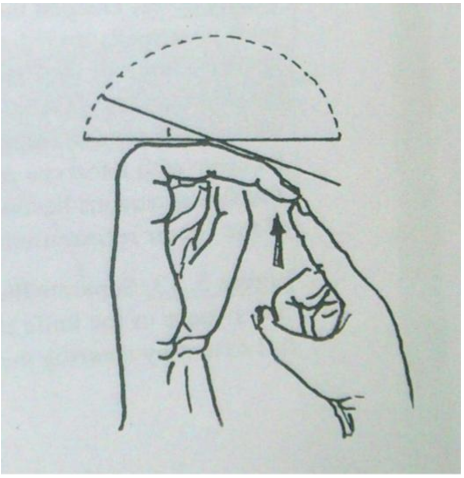
Press the flexed proximal phalanx down with the goniometer , ask the patient to straighten the finger at the PIP joint and measure the PIP joint angle . In normal hand this angle is 0^{o} ,indicating extensor apparatus is intact and normal . Assisted extension angle up to 20^{o} is accepted

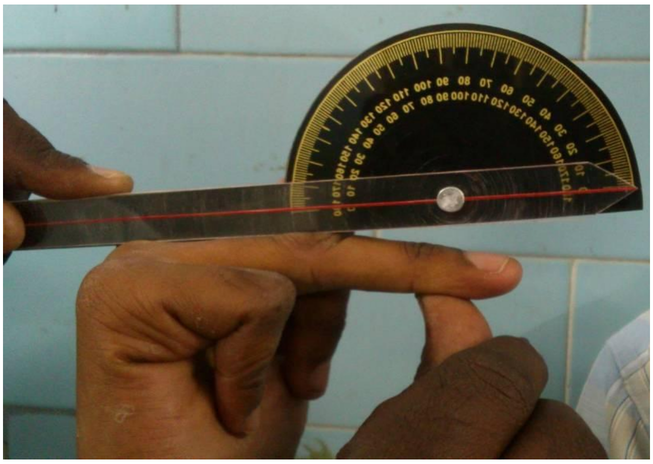
.

Assisted angle measurements

4. CONTRACTURE ANGLE[59]

This is angle measured when assisted angle is present . Press the flexed proximal phalanx down with the goniometer , ask the patient to straighten the PIP joint fully **,** Extend the semi flexed proximal phalanx to the extend possible . Angle is measured at PIP joint





Contracture angle measurements

Contracture should be released by physiotherapy. This angle upto 30^{o} acceptable.

MATERIALS AND METHODS

Patients with the mobile claw hand deformities due to the complete ulnar nerve paralysis are taken up for our study.

TOTAL NO OF THE PATIENTS – 12 cases

1.AGE DISTRIBUTION

Mean Age – 32 yrs(range 18 -50 yrs)

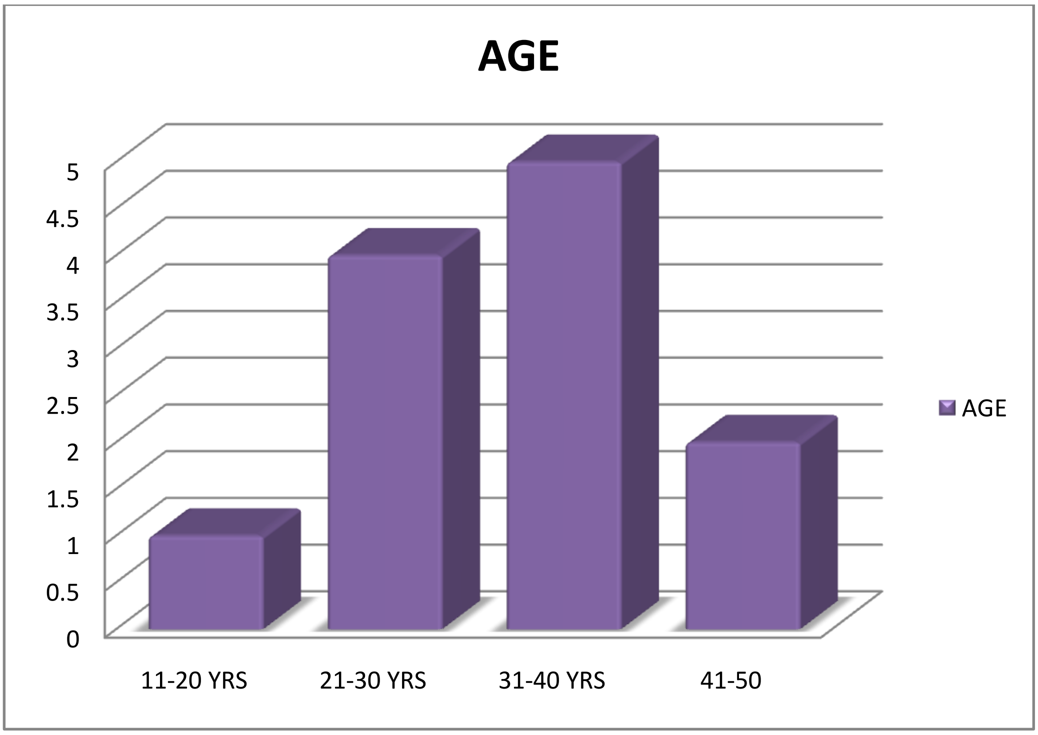


TABLE: 1.AGE DISTRIBUTION

AGE	11-20	21-30	31-40	41-50
NO OF PATIENTS	1(8 %)	4(33%)	5(42%)	2 (17%)

2.SEX RATIO

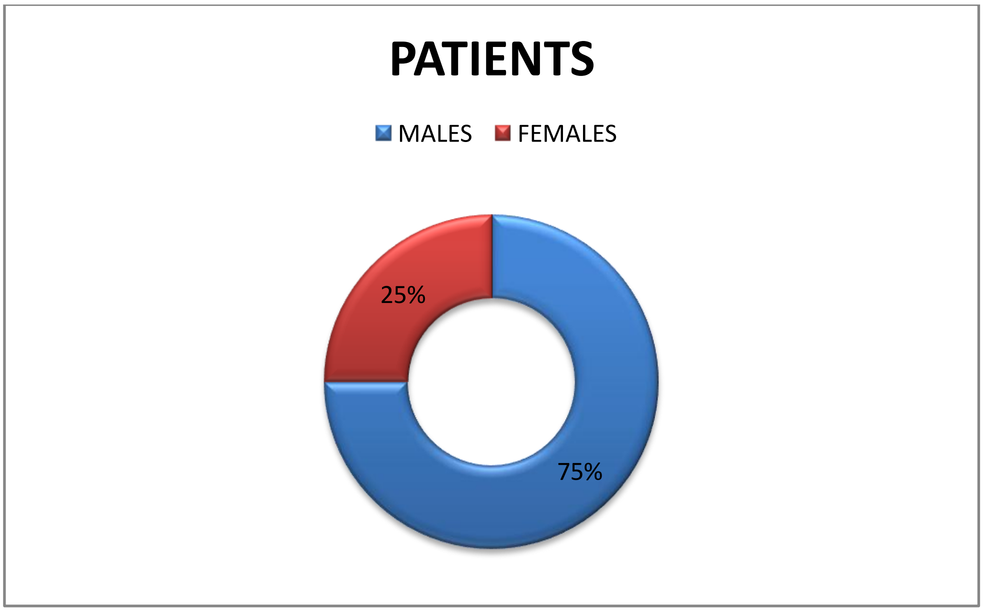


TABLE ;2. SEX RATIO

SEX	MALE	FEMALE
NO O F PATIENTS	9	3

3.DIAGNOSIS OF THE PATIENT

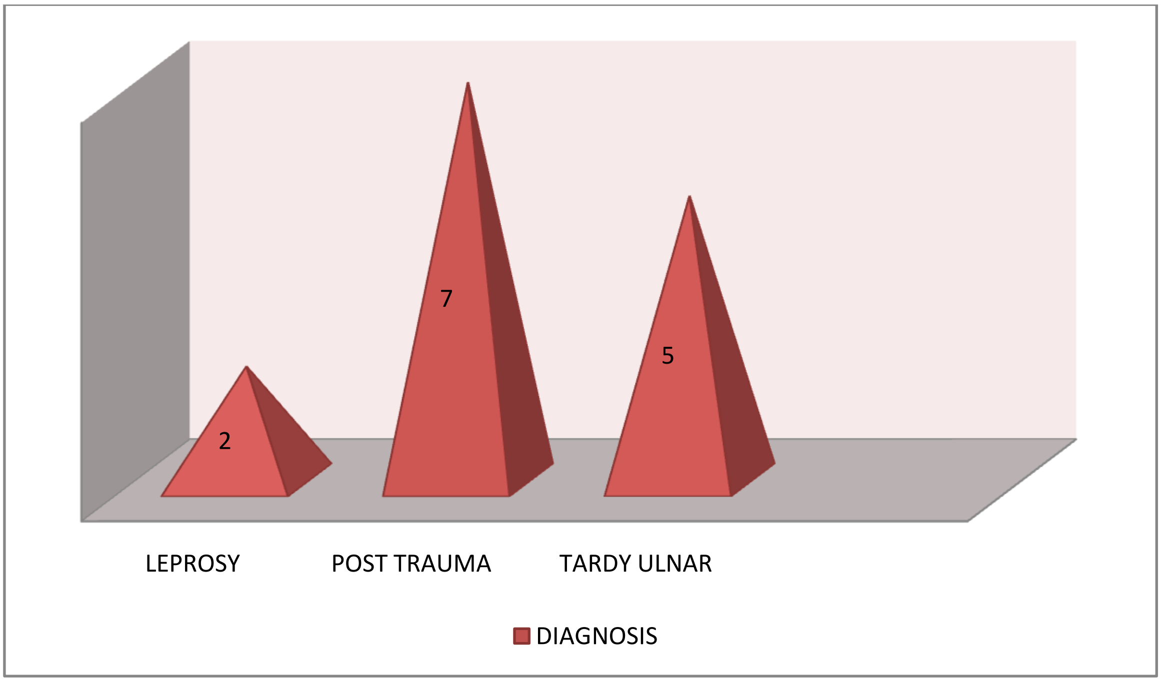


TABLE: 3.DIAGNOSIS OF THE PATIENT

DIAGNOSIS	LEPROSY	POST TRAUMATIC	TARDY ULNAR NERVE PALSY
NO OF PATIENTS	2 (17%)	7 (58%)	3 (25%)

4. LEVEL OF THE ULNAR NERVE PALSY

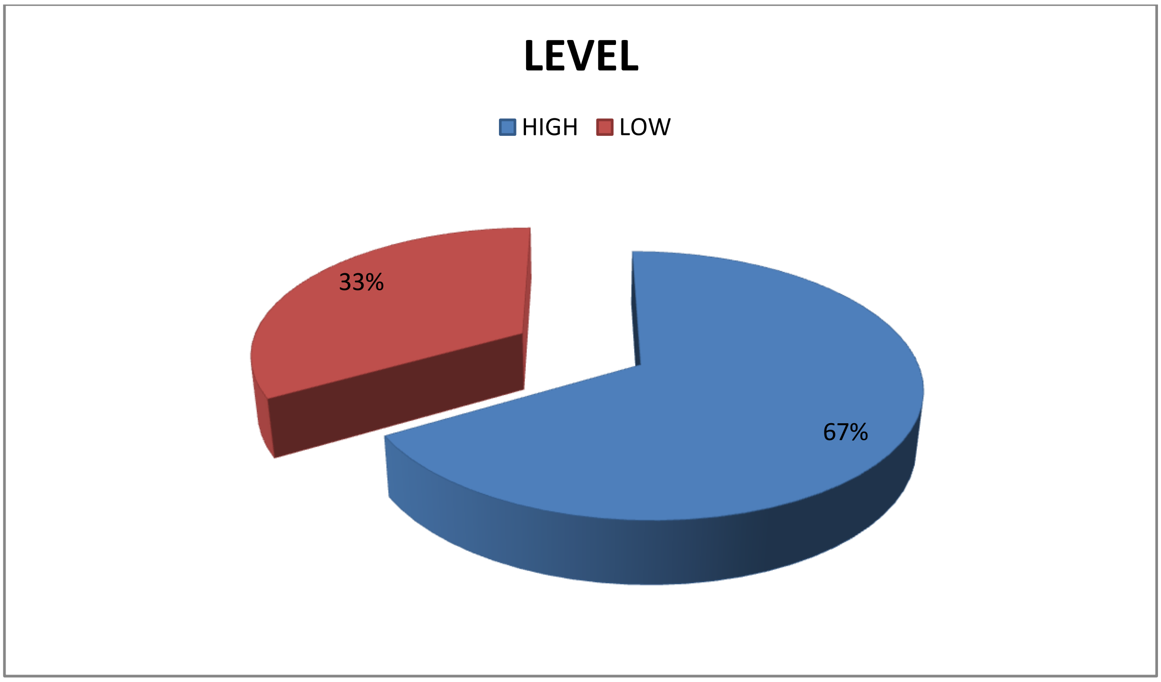


TABLE: 4. LEVEL OF THE ULNAR NERVE PALSY

ULNAR NERVE PALSY	HIGH	LOW
NO OF PATIENTS	8 (67%)	4 (33%)

5. SIDE OF THE LESION

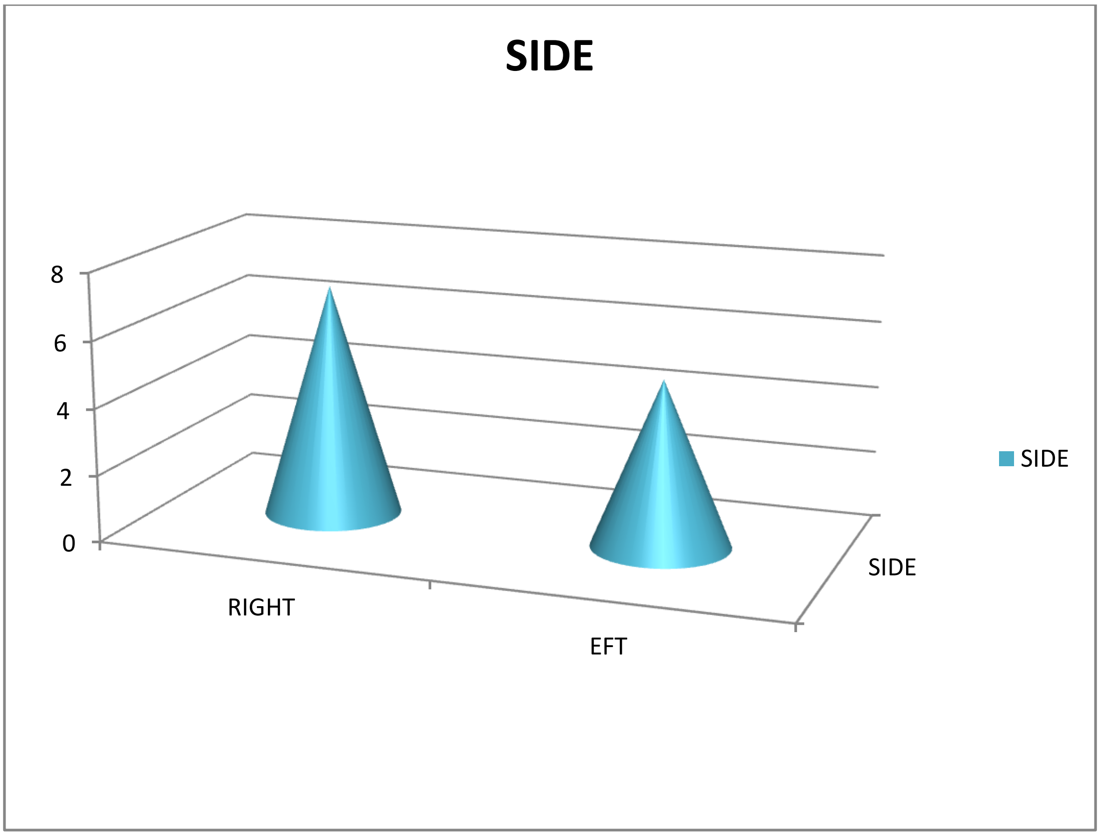


TABLE : 5. SIDE OF THE LESION

LESION	RIGHT	LEFT
NO OF PATIENTS	7 (58%)	5(42%)

6. DURATION OF THE ULNAR NERVE PALSY

Mean duration 26 months (range 16-37 months)

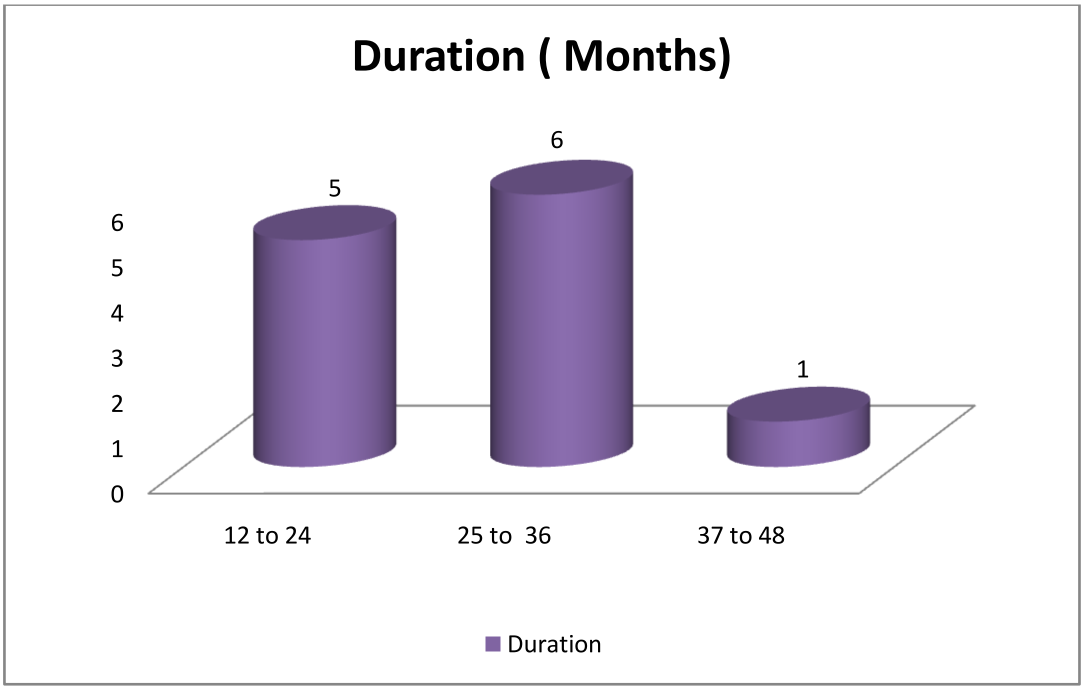


TABLE: 6. DURATION OF THE ULNAR NERVE PALSY

MONTHS	12-24	25-36	37 -48
NO OF PATIENTS	5	6	1

INCLUSION CRITERIA

1. Traumatic ulnar nerve palsy or Tardy ulnar nerve palsy not recovered after surgical treatment .
2. In cases of leprosy , after Completion of the drug therapy .
3. All the MCP and the PIP joints should be supple
4. Good function of the FDS of the middle finger

EXCLUSION CRITERIA

1. Contracture angle of the fingers more than 30^0
2. Extensor expansion damage
3. Weakness of FDS of middle finger
4. Ulcer over the finger tips and neuropathic joints.

THE ANALYSIS OF RESULTS OF THE PREOPERATIVE ANGLE MEASUREMENTS

1.MEAN DEFORMITY ANGLE

case no	MCP joint angle in open hand position	PIP joint in open hand position
1.	30	62
2	27	66
3	40	92
4	28	70
5	24	62
6	38	86
7	30	69
8	28	60
9	37	91
10	30	46
11	28	61
12	25	58
Mean	34	69

2. ANALYSIS OF RESULTS OF THE UNASSISTED ANGLE , ASSISTED ANGLE , AND CONTRACTURE ANGLE AT PREOPERATIVELY

Case no	Unassisted angle	Assisted angle	Contracture angle
1.	12	0	0
2	16	0	0
3.	31	12	6
4.	20	0	0
5.	18	0	0
6.	26	21	16
7.	8	0	0
8	10	0	0
9	32	12	12
10	6	0	0
11.	10	0	0
12.	12	0	0
Mean	17	18	11

The mean unassisted angle is $17\ ^{0}$,the mean assisted angle is 18^{0} and the mean contracture angle is 11^{0} (in three patients)

SURGICAL TECHNIQUES

ANAESTHESIA**:**

Regional anaesthesia (supra clavicular block) was used for all the patient

DIRECT LASSO PROCEDURE DESCRIBED BY ZANCOLLI[45]

Insertion of the middle finger of the FDS tendon divided into 4 tails and inserted into the A1,A2a pulleys of the all four fingers

An oblique volar incision was made over the middle phalanx and the FDS tendon was sectioned between the C1 and C2 pulleys . Then the FDS tendon was retrieved through a proximal incision along the thenar crease and divided into 4 slips . A long transverse incision was made along the distal to the distal transverse crease . The proximal and distal skin flaps were raised . Distally A1 and A2 pulleys were exposed and proximally the proximal end of fibrous flexor sheath were exposed.

The FDS tendons were tunnelled and brought to the distal transverse incision. The FDS slips were routed through the A1, A2a pulleys. A rent was made over the A2a pulley and as the infant feeding tube was passed from distal to proximal and brought out through the distal end of fibrous flexor sheath. Now the FDS slips were tied to the infant feeding tube and tunnelled through A1and

A2 pulley and brought out. The tendon slips were folded back and attached to themselves by a pulvertafts weave[46] thechnique with 4-0 prolene.

With the wrist in neutral position the tendon slips are tensioned ideally to produce MCP joint flexion angles of 50° to 70° with higher flexion in the ulnar digits. Wound closure was done . A dorsal POP was applied with wrist in neutral position and MCP joint in 90^0 flexion and IP joints in extension.

Oblique volar incision & Incision of the FDS tendon

The clinical photograph showing the proximal incision for retrieving the FDS tendon and the distal transverse incision for exposing the A1,A2 pulleys

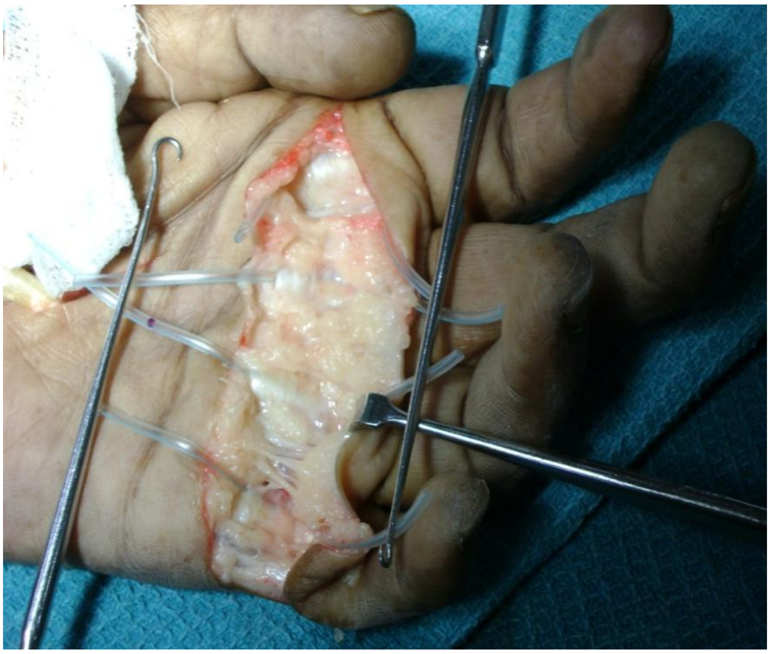
The FDS tendon retrieved from the middle finger

Figure shows the FDS tendon of two slips

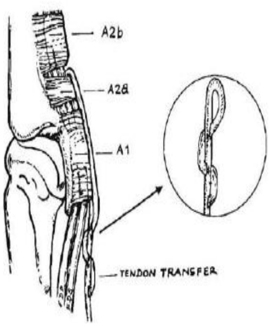
Figure shows the FDS tendon of each slips divided into 2 slips

The FDS tendon divided into 4 slips

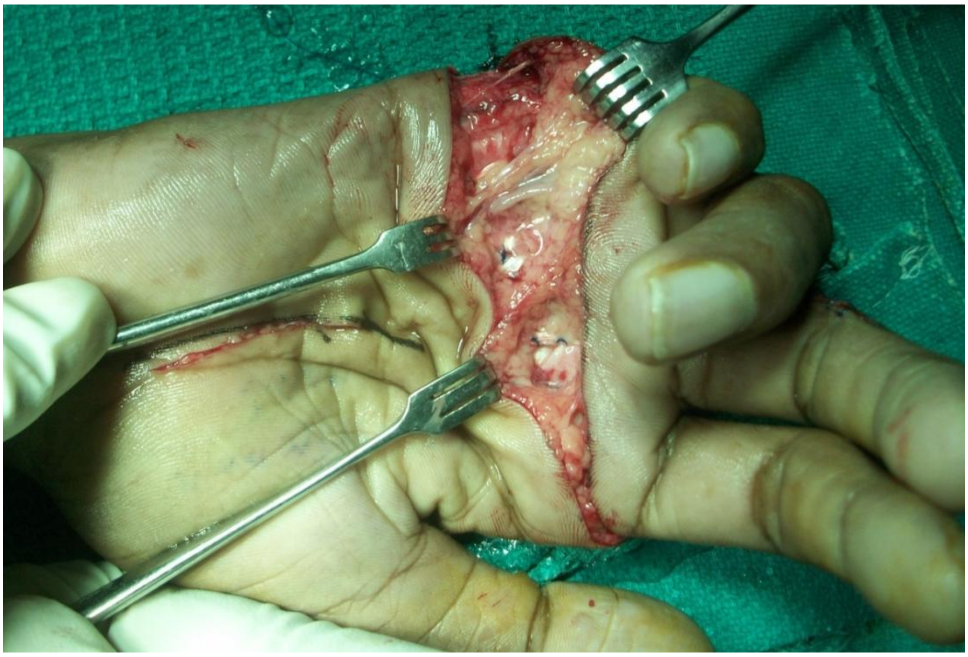
The FDS tendons were tunnelled and brought to the distal transverse incision



A rent was made over the A1 and A2a pulley



Pulveratafts weave

.


All 4 tail were inserted into A1 , A2a pulleys

wound closure with high ulnar finger flexion

Figure shows dorsal POP and MCP joint flexion and wrist in neutral.

POSTOPERATIVE REHABILITATION

The fingers were actively mobilized from the 2nd post operative day . The patient was advised to flex the MCP joints followed by the PIP joints. While opening the fist, the PIP joints are extended first followed by the MCP joint extension . The physiotherapy was followed for 5 times / 2 hours for first two 2 weeks then 5 times / hour for next two weeks . The POP was replaced by a dorsal blocking splint at the time of suture removal.

The MCP and the PIP joint angles were measured at the end of 2rd week. At the end of 4 weeks the splint was removed and light functional activities are begun. A night splint is worn upto 3 months keeping the MCP joints in 30^0 flexion. Patients were discharged after achieving independent ability to perform daily living activities like, dressing, grooming and eating.

Active mobilisation from 2nd postoperative day

Dorsal blocking split

POSTOPERATIVE ASSESSMENT

The MCP joint and the PIP joint angles in the open hand position provides an objective assessment of the deformity correction and intrinsic plus position provides an assessment of the tendon transfer integration. The angles were measured using a goniometer over the dorsum.

1.OPEN HAND POSITION FOR DEFORMITY CORRECTION

The MCP joint and PIP joint angles were measured with patients actively extending the MCP joints to the maximum possible extent .

Figure shows the Measurement of the MCP and PIP joint angles in the open hand position

2.INTRINSIC PLUS POSITION :

Patients were advised to actively attempt to flex the MCP joint and keeping the PIP joint in extension. The MCP and PIP joint angles were measured

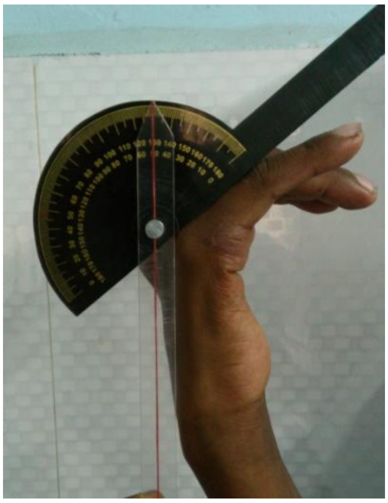


Figure shows The .MCP, and the PIP joint angle measurement in intrinsic plus position

3.FIST CLOSURE.

The ability of the finger tips to reach the distal palmar crease or proximal palmar crease or inability to touch the palm with active fist closure is noted.

FOLLOW UP

Angles were recorded biweekly for 2 months and then every month for 6 months

EVALUATION OF RESULTS

While evaluating the results of surgical procedures , the following factors were taken into consideration.

1.TENDON RUPTURE DURING ACTIVE MOBILIZATION

Any sudden increase in MCP joint extension with loss of active MCP joint flexion indicates the transferred tendon ruptures

2. MORBIDITY

The time required from the day of surgery to the patient able to perform daily living activities like dressing and eating

3.DEFORMITY CORRECTION

At 6th month follow up the MCP & the PIP Joint angles were measured and compared .The results of MCP and PIP joint angles in open hand position were categorized for each hand into good, fair, poor as per the criteria of Palande[47]

In our study all the 12 operated patients were followed and angles were recorded for each digit.

THE CRITERIA OF PALANDE[47]

	MCP joint angle in the open hand position	PIP Joint angle in open hand position
GOOD	**Hyperextension of 10° and 30° of flexion.**	**Neutral or 20° of extension lag**
FAIR	**Hyperextension of 20° and 50° of flexion.**	**Extension lags of 21^0 to 30°**
POOR	**MCP joint in > 50° of flexion**	**Extension lag > 30°**

4. **TRANSFER INTEGRATION IN INTRINSIC PLUS POSITION**

This is graded as

Good: PIP angle at <30 , Fair: PIP angle 31 ° to 60° , Poor: PIP angle> 60°

5. FIST CLOSURE

At the 6th month follow up results were categeroized as

Good: when finger tips touch the distal palmar crease.

Fair: when finger tips touch the palm but fell short of the distal crease

Poor: when finger tips could not touch the palm.

(i). BASED ON THE ABOVE FACTORS OUR RESULTS OF EARLY ACTIVE MOBILISATION WERE COMPARED WITH PUBLISHED REPORTS OF THE CONVENTIONAL IMMOBILISTION OF TENDON TRANSFER FOR CLAW HAND DEFORMITY CORRECTION

(ii). WE ALSO COMPARED OUR RESULTS OF THE EARLY ACTIVE MOBILISATION WITH PUBLISHED REPORT OF THE EARLY ACTIVE MOBILISATION OF TENDON TRANSFER FOR CLAW HAND DEFORMITY CORRECTION BY OTHER AUTHORS

RESULTS

A prospective study was conducted in our institution on 12 patients with claw hand deformity from May 2010 to November 2012. All the patients were treated with lasso procedures and early active mobilisation protocol was followed.

The following observations are made in this study :

1.The affected male and female ratio is 3:1

2.The most common age group affected is 4^{th} decade (43 %)

3.The most common cause of the ulnar nerve palsy is post traumatic etiology (58%)

4.The most common level of the ulnar nerve palsy is high ulnar nerve palsy (67%)

5. The right side (67%) is more commonly affected .

6 .The mean duration of the ulnar nerve palsy is 26 months

7. Three patients had the mean contracture angle of 11 degree (range 6 -16^{o}), which was managed with physiotherapy and splinting preoperatively.

The following are the results of the study:

1.There was no incidence of the transferred tendon rupture during early active Mobilisation

2. The mean morbidity was 34 days (range 29 -38 days)

3.The morbidity was reduced by 20 days (37%) with early active mobilisation compared with Rath immobilisation group

4. The analysis of results of the deformity correction in the open hand position (MCP joint and PIP joint angles) as per the criteria of Palande shows 82% of the patients had good deformity correction , 10% had fair results and 8% had poor results.

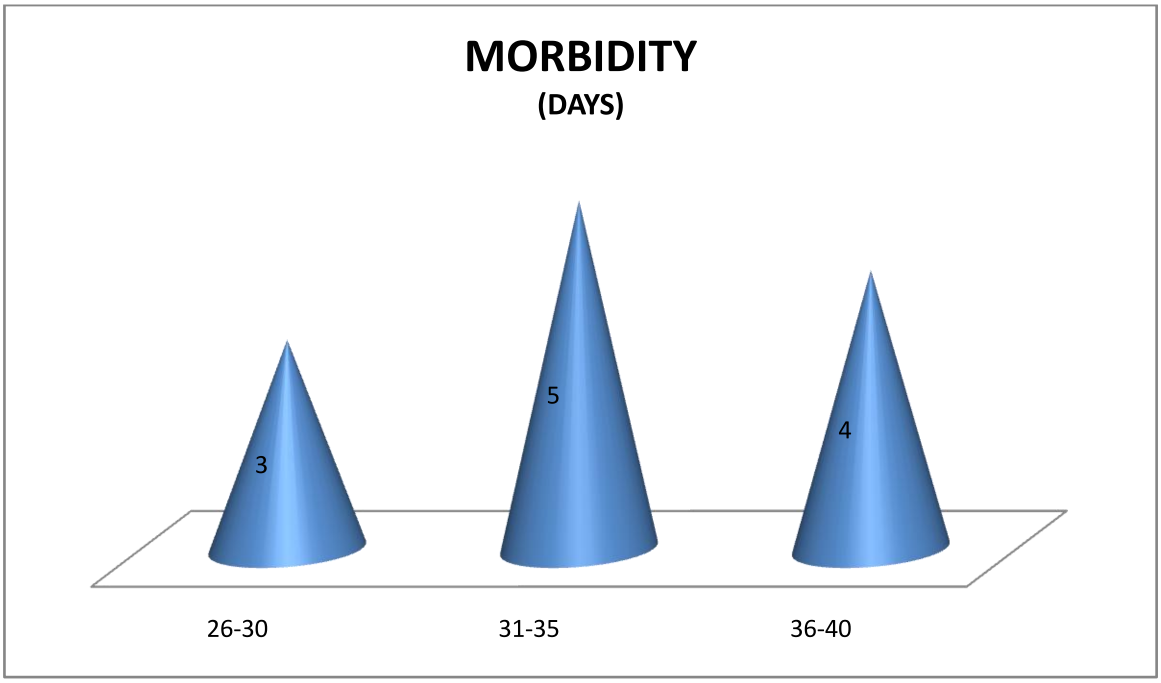
5. The analysis of results of the tendon transfer integration in intrinsic plus position shows good results in 91% of the patients and fair in 6% and poor in 3% of the patients

6. The analysis of the results of fist closure at the follow up of 6 th month shows 74% of the patients had good results , 20% of the patients had fair results and 6% in poor results

7. Comparision of the early active mobilisation results with published reports of immobilisation of tendon transfer for claw hand deformity correction shows better outcome and also added benefit of reduced morbidity.

Table 7. The analysis of results of the morbidity of early active mobilisation

Morbidity	26 -30 days	31 -35 days	36-40 days
No of the pts	3	5	4



The mean morbidity is 34 days (range 29-38) days

Table 8: The analysis of results of the deformity correction in the open hand position of the MCP joint and PIP joint angle as per the criteria of Palande

Deformity correction	Good	Fair	Poor
No of the digits	39 (82%)	5 (10%)	4(8%)

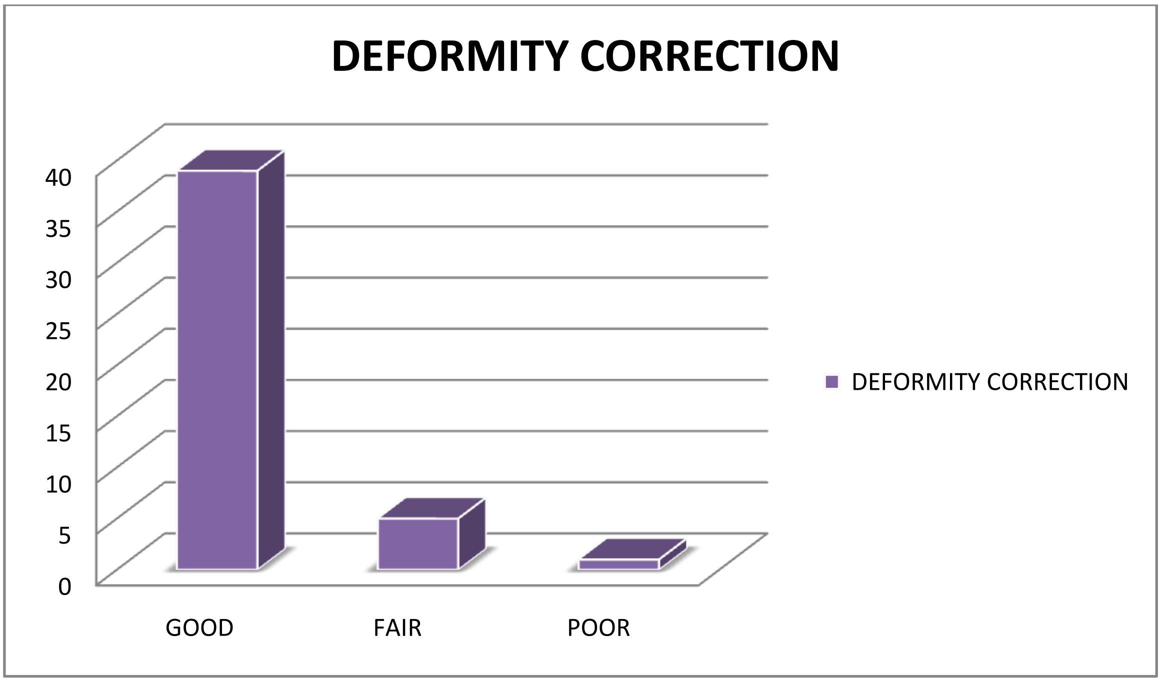


Table 9: The analysis of results of the tendon transfer integration in intrinsic plus position of the PIP joint angle as per the criteria of Palande

Tendon transfer integration	Good	Fair	Poor
No of the digits	44 (91%)	3(6%)	1(3%)

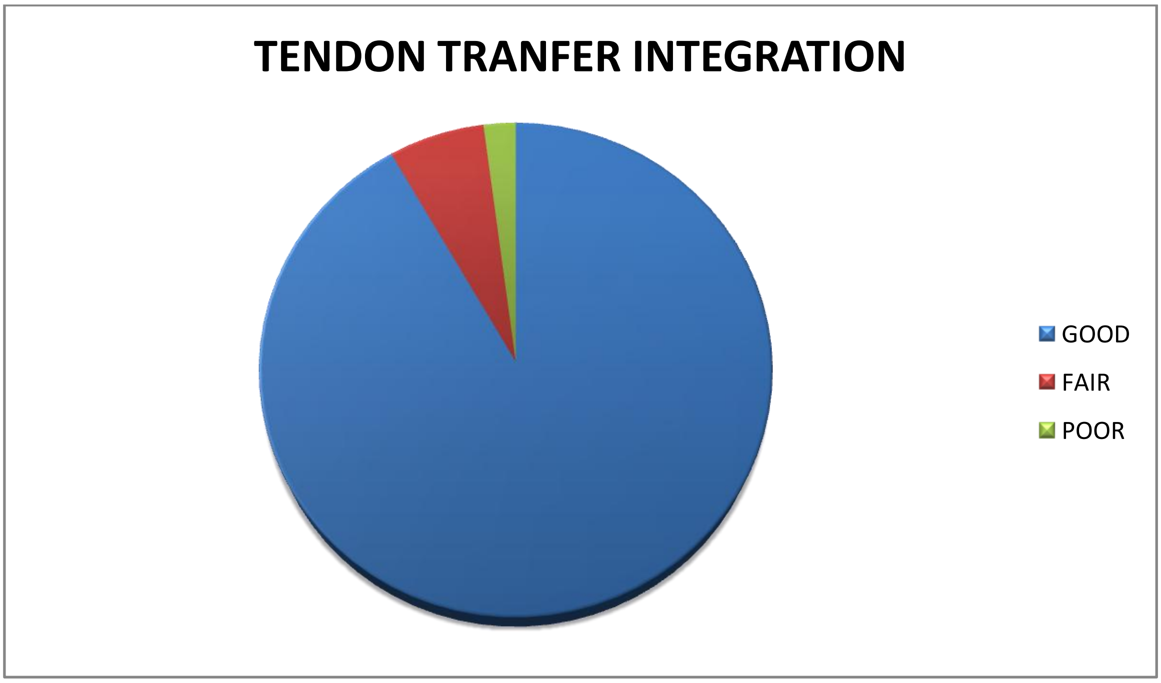


Table : 10. The analysis of the results of fist closure at the follow up of 6 th month

Fist closure	Good	Fair	Poor
No of the digits	36 (74%)	9 (20%)	3 (6%)

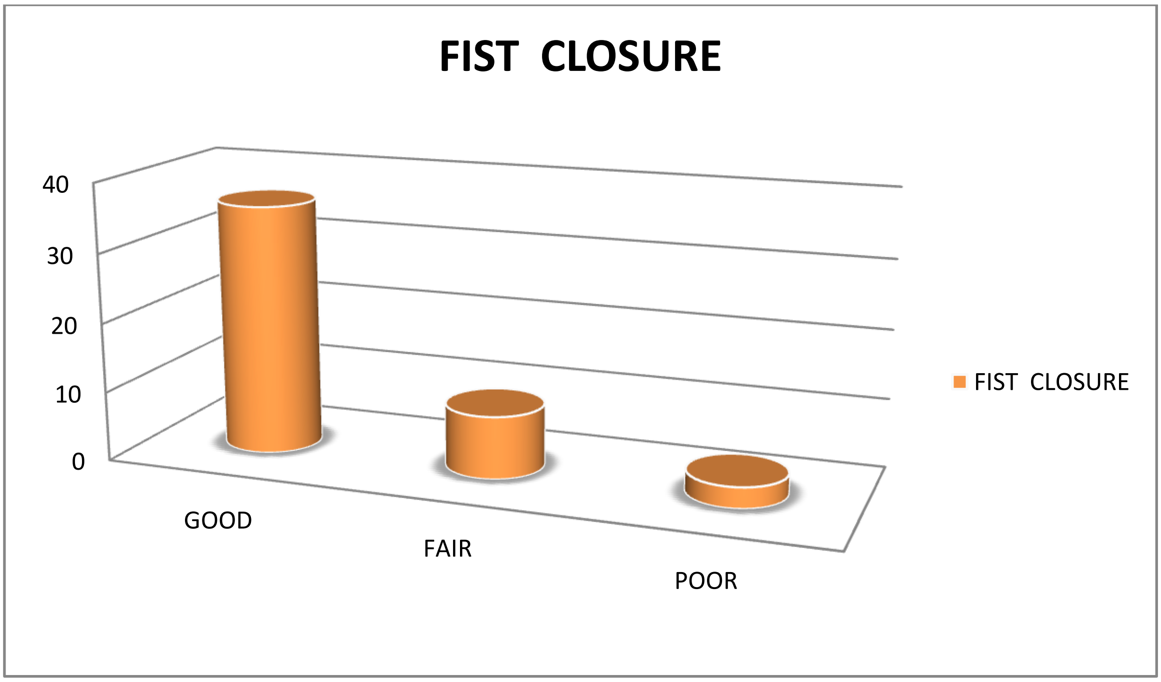


TABLE : 11 .COMPARISION OF THE EARLY ACTIVE MOBILISATION RESULTS WITH PUBLISHED REPORTS OF THE CONVENTIONAL IMMOBILISTION OF TENDON TRANSFER FOR CLAW HAND CORRECTION

deformity correction	Patond[48] 99 H n =322D	Hasting & Mccollam[49] 12 Hands	Anderson[50] 96 H ands	Rath [51] Immobil isation 32 H n =127 D	Our study of early active mo bilisation 12 H n=48D
Good	**n =262 81%**	**n = 19 83 %**	**86%**	**n =81 63%**	**n=39 82%**
Fair				**n = 23 18%**	**n =5 10%**
Satisfactory (good+Fair)	**81%**	**83%**	**86%**	**81%**	**92%**
poor		**n = 4 17%**		**n =23 D 19%**	**n = 4 8%**

H =Hands , N = No of digits , D= digits

The satisfactory results of deformity correction with early active mobilisation are better than those in the published reports of conventional immobilisation.

TABLE 12 :COMPARISION WITH THE EARLY ACTIVE MOBILISATION WITH RATH PUBLISHED REPORT OF THE EARLY ACTIVE MOBILISATION OF TENDON TRANSFER FOR CLAW HAND DEFORMITY CORRECTION

DEFORMITY CORRECTION	GOOD	FAIR	POOR
EARLY ACTIVE MOBILISATION	82%	10%	8%
RATH IPAM	84%	9%	7%

COMPLICATION

During the postoperative follow up of early active mobilisation , One (8%) patient had donor digit PIP joint flexion contractue of little finger , which was released by surgically by volar capsulotomy and the deformity was corrected .

ILLUSTRATIVE CASES

CASE :1.

A case of tardy ulnar nerve palsy, in which the ulnar nerve transposition was done earliar.

Pre operative photograph




Postoperative photograph



CASE :2

A case of post traumatic low ulnar nerve palsy

Preoperative

Post operative

CASE :3

A case of posttraumatic high ulnar nerve palsy

Pre operative

Postoperative

Case .4

A case of posttraumatic low ulnar nerve palsy

Preoperative



Postoperative



Case . 5

A case of posttraumatic high ulnar nerve palsy

Preoperative

Postoperative

Case 6.

A Case of leprosy with ulnar nerve palsy

Preoperative

Postoperative

COMPLICATION – PIP JOINT CONTRACTURE

Case ; 7

Preoperative

Postoperative

DISCUSSION

The evolution of the tendon transfer techniques and the principles were developed over 200 years ago . The earliest tendon transfer was described by Velapeau in 1839 and Malgaigne in 1845 for reconstruction of severed tendons . In 1882 , Nicoladoni applied the principle of the transfer of a an intact muscle to paralytic muscles of lower limb. Bunnell described the principles of tendon transfer for hand . Brand performed first surgical correction of claw hand of leprosy patient in Christian Medical College , Vellore ,India in 1948[52].

It is the usual practice after tendon transfer surgery to immobilize the hand with pop cast for 3 – 4 weeks to allow union of the transferred tendon[53] . Subsequent to removal of the cast , post operative therapy is needed for 4 to 6 weeks . The average rehabilitation time in the conventional techniques is usually 2 to3months . The period of postoperative immobilisation contributes to 40-50% of the rehabilitation time in the claw hand deformity correction.

Early active mobilisation means starting the postoperative therapy for the transferred tendon in the first week of surgery . The principle of early active mobilisation has been proven to be safe and found to be significantly improve the outcome. The conventional immobilisation is associated with adhesion formation[31] and a poor tendon gliding.

Laboratory studies demonstrated that the early mobilized tendon healed faster , gained tensile strength quicker, and had better excursion . Because of the less adhesion formation than unstressed repair[54,55] early mobilized tendon healed by an intrinsic mechanism and steadily gained strength following repair[56] .

The principles behind early mobilisation techniques involve protected mobilisation in a restricted range with a dorsal blocking splint.

The early mobilisation has the benefit of reduced morbidity which will considerably reduce the loss of income for self-employed patients for undergoing surgery and loss of work compensation payment by the state.

Comparing the results of early active mobilization following FDS 4TP with published reports[62,63] of pulley insertion and immobilization has limitations as the outcomes measures in these reports are not defined[26] or uniform between the studies· The factors taken into consideration for assessment of results in the published reports i.e. deformity correction, integration of transfer and digit flexion have similarities to the method of assessments as per Palande's criteria used in the present study and can therefore be compared . The satisfactory i.e. combined good and fair results of deformity correction with early active mobilisation are better than those in the published reports of conventional immobilisation.

Anderson[57] allowed use of the hand with a knuckle bender splint 7 weeks after surgery. Klein[58] recommended a period of 12 weeks after surgery to allow splint free hand activities. In our study the early active mobilisation patients used hands for activities of daily living on an average of 5 weeks (34 days) after surgery.

It is postulated that pre-operative isolation of FDS middle finger improves the 'individuation index' of the little, ring and index finger by establishing new neuronal networks in the brain. Early post operative mobilization activates the new neuronal networks in the brain as described by Bezuhly[60] whereas immobilization may temporarily erase these neuronal networks. In addition immobilization of the transfer will temporarily erase the cortical representation of FDS middle finger is as demonstrated by de Jong et all[61] with dynamic immobilization of flexor tendons.

The study of de Jong et al[41] demonstrated the impact of a relatively short period of immobilization of digits on the functional organization of the brain. A 6 week period of immobilization induced temporary loss of efficient cerebral control of hand movement. Functional restoration of hand movement occurs in 6-8 weeks time with use of the hand..

The major limitation of this study is comparing the results of a prospective trial (early active mobilisation) with retrospective historical data

CONCLUSION

- The early active mobilisation is safe and has the better outcomes of deformity correction compared to immobilisation with a selected donor with a strong insertion.
- Increased strength of tendon transfer insertion and protection of the insertion during early active mobilisation are the two essential requirements for this new tendon transfer rehabilitation protocol.
- Wider application of this principle to other tendon transfer can be investigated with incorporating the above two principles.
- Future randomized controlled trials will provide insight into the differences in post operative behavior of the tendon transfer with early mobilization versus immobilization.
- The neurophysiologic basis of the isolation of donor, integration of tendon transfer and movement restoration can now be tracked in the immediate postoperative period with functional MRI or PET scans.

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PROFORMA

NAME	**:**	
		I.P.NO:
AGE & SEX	**:**	
DATE OF ADMISSION	**:**	
DATE OF SURGERY	**:**	
DATE OF DISCHARGE	**:**	
DIAGNOSIS	**:**	
SIDE OF THE LESION	**:**	
LEVELOF THE LESION	**:**	
DURATION OF NERVE PALSY	**:**	
PROCEDURE	**:**	
HISTORY	**:**	DEFORMITY OF HAND AND DURATION , .
.		DIFFICULTTY IN USING HAND.
.		NATURE OF INJURY .
		HANSENS DISEASE
CLINICAL EXAMINATION	**:**	
		1.CLAW FINGER .
		2.MOBILE MCP AND PIP JOINTS
		3.FUNCTION OF THE FDS IN 3^{RD} FINGER .
		4. FLEXOR CONTRACTURE
PRE OPERRATIVE EVALATION	**:**	1.CLAW DEFORMITY ANGLE
		2.UNASSISTED ANGLE MEASUREMENTS
		3.ASSISTED ANGLE MEASUREMENTS
		4.CONTRACTURE ANGLE
SURGICAL PROCEDURE	**:**	FDS 4TP IS SIMILAR TO THE DIRECT LASSO .
.		PROCEDURE

TENDON TO TENDON ANSTOMOSIS BY PULVERTAFTS WEAVE .

POSTOPERATIVE REHABLITATION

THERAPY PROTOCOL

ASSESSMENT

ANGLES ARE RECORDED IN BIWEEKLY

ANGLES	**MCP JOINTS**	**PIP JONTS**
1.OPEN HAND POSITION		
2. INTRINSIC PLUS POSITION		
MEAN		

FOLLOW UP

EVERY MONTH FOR 6 MONTHS

EVALUATION

1.TENDON RUPTURE DURING ACTIVE MOBILISATION

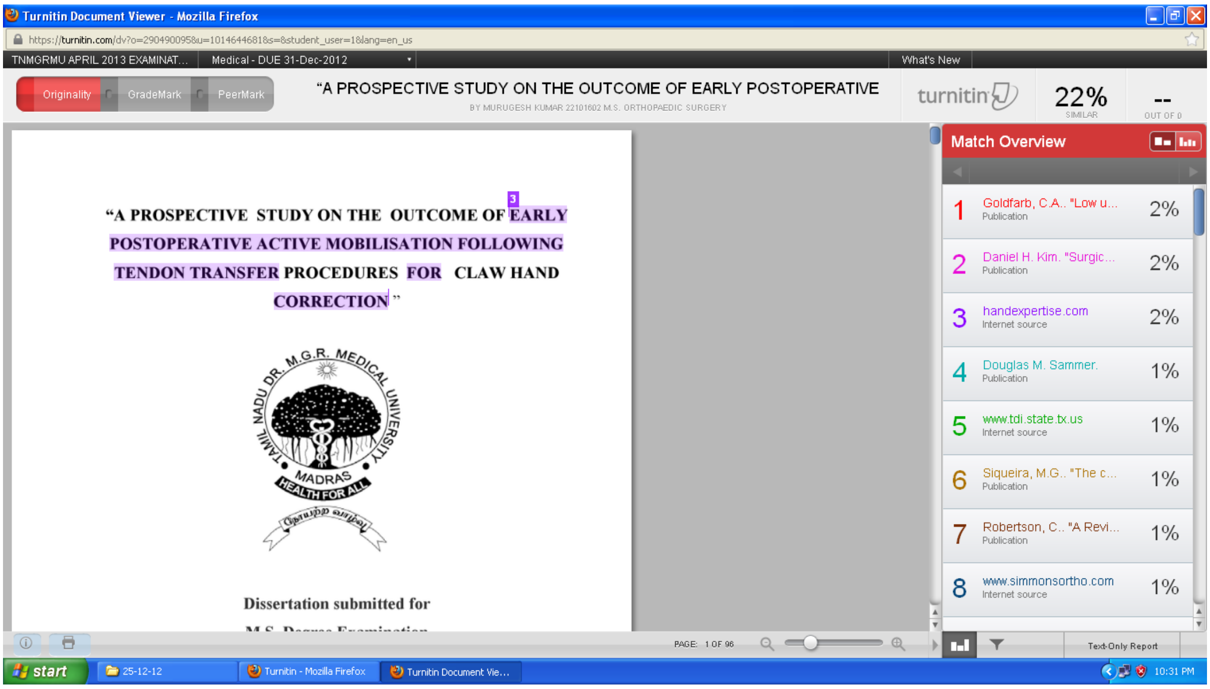
2.MORBIDITY

3.FIST CLOSURE

4.COMPARISION OF EARY ACTIVE MOBILISATION WITH IMMOBILISATION

RESULTS

COMPLICATION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Dr. N. Mohan, M.S., F.I.C.S., F.A.I.S.,
Dean, Madurai Medical College & 2521021 (Secy)
Govt Rajaji Hospital, Madurai 625020.
Convenor
grhethicssecy @gmail.com.

Sub: Establishment-Govt. Rajaji Hospital, aMadurai-20-
Ethics committee-Meeting Agenda-communicated-regarding.

The Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held at 12.00 Am to 1.30.Pm on 26.07.2012 at the Dean Chamber, Govt. Rajaji Hospital, Madurai. The following members of the committee have been attended the meeting.

1. Dr.N.Vijayasankaran,M.ch(Uro.) 094-430-58793 0452-2584397	Sr.Consultant Urologist Madurai Kidney Centre, Sivagangai Road,Madurai	Chairman
2. Dr.P.K. Muthu Kumarasamy, M.D., 9843050911	Professor & H.O.D of Medical. Oncology(Retired)	Member Secretary
3. Dr.T.Meena,MD 094-437-74875	Professor of Physiology, Madurai Medical College	Member
4. Dr. S. Thamilarasi, M.D (Pharmacol)	Professor of pharmacology	
5.Dr.Moses K.Daniel MD(Gen.Medicine) 098-421-56066	Professor of Medicine Madurai Medical College	Member
6.Dr.M.Gobinath,MS(Gen.Surgery)	Professor of Surgery Madurai Medical College	Member
7.Dr.S. Dilshadh, MD(O&G) 9894053516	Professor of OP&Gyn Madurai Medical College	Member
8.Dr.S.Vadivel Murugan., M.D, 097-871-50040	Professor of Medicine Madurai Medical College	Member
9.Shri.M.Sridher,B.sc.B.L. 099-949-07400	Advocate, 2, Deputy collectors colony 4th street KK Nagar, Madurai-20.	Member
10.Shri.O.B.D.Bharat,B.sc., 094-437-14162	Businessman Plot No.588, K.K.Nagar,Madurai.20.	Member
11.Shri. S.sivakumar,M.A(Social) Mphil 093-444-84990	Sociologist, Plot No.51 F.F. K.K. Nagar, Madurai.	Member

Following Projects were approved by the committee

Fwd

Prof. Dr. R.V. PUGALENTHI
M.S. Ortho., D.Ortho.,
PROFESSOR & H.O.D.
Dept. of Orthopaedic Surgery,
Traumatology & Rehabilitation.
GOVT. RAJAJI HOSPITAL

Dep. ortho

Sl. No	Name of P.G.	Course	Name of the Project	Remarks
1.	Dr. Murugesh Kumar. P	M.S Ortho	Outcome of early post-operative active mobilization vs. immobilization in patients undergoing tendon-transfer for claw-hand.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution to Government.
2. She/He should inform the institution Ethical Committee in case of any change of study procedure site and investigation or guide.
3. She/He should not deviate for the area of the work for which applied for Ethical clearance.
She/He should inform the IEC immediately, in case of any adverse events pr Serious adverse reactions.
4. She/he should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and apply for if any Extension of time is required She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the word or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

DEAN 8-9/12

To
All the above members and Head of the Departments concerned.
All the Applicants.

MASTER CHART

S. NO	NAME	AGE	SEX	DIAGNOSIS	TYPE	SIDE	DURATION MONTHS	PRE OPEATIVE ANGLES DEFORMITY ANGLE (MEAN ANGLES)					POST OPERATIVE (MEAN ANGLES)				
								OPEN HAND MCP J ANGLE	OPEN HAND PIP J ANGLE	UN ASSISTED ANGLE	ASSISTED ANGLE	CONTRACTURE ANGLE	MORBIDITY DAYS	TENDON RUPTURE	DEFORMITYCORRECTION	TRANSFER INTEGRATION	FIST CLOSURE
1.	PANDIYAN	50	M	LEPROSY	HIGH	R	19	30	62	12	0	0	30	NO	GOOD	GOOD	GOOD
2.	MANI	28	M	POST TRAUMA	LOW	R	24	27	66	16	0	0	36	NO	GOOD	GOOD	GOOD
3.	RATHINASAMY	18	M	POST TRAUMA	HIGH	R	30	40	92	31	12	6	34	NO	POOR	FAIR	FAIR
4.	PARVATY	34	F	TARDY ULNARN PALSY	HIGH	L	37	28	70	20	0	0	30	NO	GOOD	GOOD	GOOD
5.	SENTHIL	26	M	POST RAUMA	HIGH	L	18	24	62	18	0	0	32	NO	GOOD	GOOD	GOOD
6.	PANJU	32	F	TARDY ULNARN PALSY	HIGH	R	24	38	86	26	21	16	37	NO	FAIR	GOOD	GOOD
7.	MURUGAN	40	M	POST TRAUMA	LOW	R	36	30	69	8	0	0	35	NO	GOOD	GOOD	FAIR
8.	RAMESH	25	M	TARDY ULNAR	HIGH	R	16	28	60	10	0	0	29	NO	GOOD	GOOD	GOOD

				PALSY													
9	RANI	36	F	POST TRAUMA	LOW	L	28	37	91	32	16	12	32	NO	GOOD	GOOD	GOOD
10	DNANUSH KODY	46	M	LEPROSY	HIGH	L	32	30	46	6	0	0	38	NO	GOOD	GOOD	FAIR
11	ALAGAR	31	M	POST TRUAMTIC	HIGH	R	29	28	58	10	0	0	33	NO	GOOD	GOOD	GOOD
12	RAJESH	23	M	POST TRAUMA	LOW	L	26	25	61	12	0	0	36	NO	GOOD	GOOD	FAIR

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“A PROSPECTIVE STUDY ON THE OUTCOME OF EARLY POSTOPERATIVE ACTIVE MOBILISATION FOLLOWING TENDON TRANSFER PROCEDURES FOR CLAW HAND CORRECTION ” Dissertation submitted for M.S. Degree Examination Branch II – ORTHOPAEDIC SURGERY APRIL-2013 THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY CHENNAI, TAMIL NADU 1 CERTIFICATE This is to certify that this dissertation entitled “A PROSPECTIVE STUDY ON THE OUTCOME OF EARLY POSTOPERATIVE ACTIVE MOBILISATION FOLLOWING TENDON TRANSFER PROCEDURES FOR CLAW HAND CORRECTION” is the bonafide work done by Dr.P.MURUGESHKUMAR, under my supervision in the Department of Orthopaedic Surgery, Madurai Medical College, Madurai-20. Prof. Dr. P.V.PUGALENTHI, M.S Ortho., D....